ORIGINAL ARTICLE

Language co-evolved with the rule of law

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Abstract Many scholars assume a connection between the evolution of language and that of distinctively human group-level morality. Unfortunately, such thinkers frequently downplay a central implication of modern Darwinian theory, which precludes the possibility of innate psychological mechanisms evolving to benefit the group at the expense of the individual. Group level moral regulation is indeed central to public life in all known human communities. The production of speech acts would be impossible without this. The challenge, therefore, is to explain on a Darwinian basis how life could have become subject to the rule of law. Only then will we have an appropriate social framework in which to contextualize our models of how language may have evolved.

Keywords Language evolution · Human origins · Ritual · Religion · Totemism · Trust · Primates · Signal evolution · Darwinism · Menstruation · Commitment · Contracts · Reliability

1 Language and the rule of law

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 keep to agreed time limits, disclose our sources, accept criticism and renounce any temptation to use threats, material inducements or force. There is competition, certainly; but in principle at least, outcomes are determined on an intellectual basis by peer evaluation alone. We compete to demonstrate relevance in one another's eyes (Sperber and Wilson 1986; Dessalles 1998).

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What applies in academic life applies wherever language is used. Compared with scholarly 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 basic principles apply. Civilized discourse is inseparably bound up with tact, mutual face-saving and respect (Grice 1989, pp. 22–40; Leech 1980; Brown and Levinson 1987 [1978]). What I am here terming 'the rule of law' is never just behavioural dominance exerted by powerful individuals at the expense of the less powerful. Genuine law is contractual, valid only when based on consent. The relevant contracts may be formal, informal or taken for granted and correspondingly invisible. But only once contractual understandings are in place can any of us 'do things with words' (Austin 1978 [1955]; Searle 1971).

Although some scholars view language as just 'another form of behaviour' (Savage-Rumbaugh et al. 1998, p. 226), speech acts (Austin 1978 [1955]) are not in fact behavioural interventions. On the level that matters—the level that is distinctively human—participants proceed as if playing an abstract game. As in chess, moves are made in a hallucinatory domain, each player's communicative intention being fulfilled not by producing any material impact but simply by becoming recognized (Grice 1989, pp. 86–116). Intentions cost nothing. To make a move—even to transform the entire state of play—no muscular effort is required. In a game of this kind (Harris 1988; Wittgenstein 1968), the force of a move is independent of physical force. A barely perceptible wink may suffice, allowing intuitive mindreading to search for relevance and fill in any gaps (Sperber and Wilson 1986).

Language evolved when humans were hunters and gatherers. Self-organised communities of this kind are at least as harmonious and rule-governed—at least as 'civilized'—as those with courts, police or other specialized law enforcement agencies (Engels 1972 [1884]; Lee 1988; Henrich et al. 2006). Systems of kinship and marriage, for example, subordinate sex and reproduction to collective norms (Morgan 1871; Lévi-Strauss 1969). Injunctions and taboos surround matters such as incest and menstruation (Durkheim 1963 [1898]), promoting marital circulation rather as road signs and traffic lights in a modern city promote the circulation of traffic (Knight 1991, pp. 88–153). Humans need rules if they are to transcend primate-style conflict (Sahlins 1960; Rappaport 1999; Boehm 2001). The law exists to uphold behaviour of a civilized kind.

2 Primates and contractual language games

During the 1970s, researchers in the US attempted to introduce captive chimpanzees to American Sign Language. 'Booee' and 'Bruno' were two male subjects successfully induced to sign for their food. However, the animals obeyed only when this brought rewards from their trainer. When left to themselves, they gave no such rewards and so the whole system collapsed. As Roger Fouts (1975, p. 380) recorded at the time:

> The food eating situation has turned out to be somewhat of a one-way ASL communication because neither of the two males seems to want to share food with the other. For example, when one of the two chimpanzees has a desired fruit or drink the other chimpanzee will sign such combinations as GIMME FRUIT or GIMME DRINK. Generally, when the chimpanzee with the desired food sees this request he runs off with his prized possession.

The problem was not reducible to cognitive or other individual deficits. In fact, the two chimps' mindreading and symbolic capacities turned out to be remarkable (Fouts 1997). What was missing was a social universe capable of rendering American Sign Language remotely worth learning—except, of course, when the two animals' social conduct was being shaped externally by their human trainer.

Impartially applied two-way moral regulation is a human cultural ideal that is not easy to reconcile with Darwinian theoretical premises. Dawkins (2006 [1976] p. 3) concludes: 'Be warned that if you wish, as I do, to build a society in which individuals cooperate generously and unselfishly towards a common good, you can expect little help from biological nature'. It is true that animals often co-operate, punishing defectors and constraining one another's behaviour accordingly. It is equally true that impulses reminiscent of human moral feelings are a common enough feature of primate social life (e.g., De Waal 1996). A well-organized primate coalition may succeed in imposing a measure of control, pacifying subordinates in ways that may be appreciated by otherwise vulnerable individuals. But even when stable for a period, primate 'policing' of subordinates (Flack et al. 2006) remains divisive in relation to the population as a whole. Coercion imposed by one faction at the expense of its rivals may keep the peace temporarily but is a different concept from the rule of law applied impartially to all. Primate societies are in no sense morally self-regulated communities.

Primate dominance is bound up inextricably with social and sexual inequality (Zuckerman 1932; Dunbar 1988). One-sided and unaccountable, it has nothing in common with group-level moral regulation. Boehm (2001) argues that human hunter–gatherers police themselves by forming a coalition so inclusive as to embrace everyone in the community. By establishing the rule of law in this way, according to this argument, our hunter–gatherer ancestors may have constructed the social niche necessary for languages, religions and other aspects of symbolic culture to evolve. But the existence of a coalition embracing everyone is not easy to explain. By definition, a coalition is an alliance formed by certain individuals in opposition to others.

3 Darwin versus Chomsky

Language-like phenomena do not evolve or even begin to evolve in nature. Apes and monkeys vocalize in various meaningful ways, but language is based on 'an entirely different principle' (Chomsky 1988, p. 183). In an effort to reconcile Chomsky's theories with Darwinian gradualism, some scholars have sought evolutionary precursors of language not in the gesture-calls of primates but instead

in their much more complex internal cognition (Ulbaek 1998; Burling 2005). The recent minimalist turn inaugurated by Chomsky (1995) can be interpreted, at least in part, as a contribution in this spirit. Chomsky attempts to head off previous Darwinian criticism of his theories by minimizing the amount of genetically specified cognitive re-wiring theoretically required to yield language. Chomsky and colleagues (Hauser et al. 2002) now claim that recursion—already a feature of primate cognition—was sufficient to accomplish the transition, its harnessing to serve syntactic functions occurring not on a slow Darwinian timescale but in one step. Far from satisfying Chomsky's critics, however, the suggestion has provoked intensified incredulity and hostility (Newmeyer 2003; Botha 2003; Pinker and Jackendoff 2005).

Underlying Chomsky's new position is the perceived need to demonstrate how the human language faculty might have been assembled from features of cognition found more widely in nature. It was once widely assumed that nothing short of profound changes in innate cognitive architecture could have set the ancestral human brain on the road toward language. In recent years, however, evidence against this view has been accumulating. The abilities of Alex the parrot in fact suggest that the 'necessary neural substrates for behavioural precursors to language can evolve in any reasonably complex vertebrate brain, given the right socio-ecological selection pressures' (Pepperberg 2005, pp. 239–240). If this is accepted, we need to explore what those selection pressures might have been.

Wild-living primates produce neither conventional languages nor even any obvious evolutionary precursors. Is this because they are not subject to 'the right socio-ecological selection pressures'? It seems a likely possibility. 'Without language, culture could not exist; but without the rest of culture, language would have no function' (Trager 1972, p. 6). Wittgenstein (1968) remarked that 'to imagine a language means to imagine a form of life'. Can we envisage the operation of 'illocutionary force' (Austin 1978 [1955]) in a world devoid of conventional protocol or law? Illocutionary force is real but not physical. No device could detect or measure such force: it exists only for a mind capable of grasping contractual commitment. The amount of energy required to produce or switch between alternative speech acts is roughly zero. If there is compulsion in such an act, it is purely contractual. Navigation within the domain of contractual understandings is conceivable only against a logically prior background of distinctively human sociality and co-operation (Grice 1989).

For language to work, in short, there has to be a deeper, sub-linguistic level of mutual understanding already built up in relation to the most important things and underpinning any agreement on the more superficial level of purely linguistic usage. Language, to quote Saussure (1974 [1915] pp. 5, 14), is 'a product of the collective mind of linguistic groups'; it 'exists only by virtue of a sort of contract signed by the members of a community'. Why does language evolution not happen in nature? The answer is that languages are institutional facts. Their existence presupposes community-wide contractual commitment—something that for deep reasons is impossible in the animal world (Dawkins 2006 [1976]; Maynard Smith and Szathmáry 1995; Zahavi 1993).

4 The Machiavellian ape

Trivers (1971) believed that animals with sufficiently complex brains could ensure cooperation by systematically punishing defection. But punishment is itself a costly activity and therefore raises a second order problem of cooperation vulnerable in turn to defection. Think of irresponsible humans who throw their litter all around, or conference-attending academics who indulge in frequent flying regardless of the environmental costs. Although we may feel uncomfortable about such behaviour in others, the temptation is always to let someone else go to the trouble of meting out the necessary punishments. When everyone adopts this line of least resistance, violators go unpunished—leaving the environment and its inhabitants to suffer the costs.

Axelrod (1986) ran a computer simulation showing that punishment can prove evolutionarily stable, but only if those who refuse to punish are in turn punished on that account. But who is to do this second order work of systematically punishing those who do not punish? Axelrod concluded that the only realistic solution is to use taxes to pay professional enforcers such as judges, magistrates and police. 'Of course', as Zahavi and Zahavi (1997, p. 133) point out, 'such professional enforcers do not exist in nature'. A moment's reflection on our own species should remind us that despite the supposed legality of the present global market, effective enforcement of environmental legislation is not an easy task.

Reciprocal altruism (Trivers 1971) in the animal world may work on a local scale between frequently interacting allies. Ape social intelligence is higher than in most animals, but there is no evidence that it leads automatically to correspondingly higher levels of cooperation. In general, apes appear indifferent to the welfare of unrelated group members (Silk et al. 2005). In large groups, cooperation through kin selection (Hamilton 1964) ceases to work, since the effectiveness of shared genes falls off precipitously as genetic distance increases. The same applies to direct reciprocity, since the ability to monitor trustworthiness decreases rapidly with increasing group size (Enquist and Leimar 1993; Dunbar 1999). Lacking community-wide bonding mechanisms, primate social groups quickly fall apart as population expands.

If ancestral human communities were to overcome such problems, novel bonding mechanisms had to be found. 'Strong reciprocity'—behavioural regulation powerful enough to enforce co-operation between strangers—is a term that has recently gained currency, corresponding roughly to what is here termed 'the rule of law'. It presupposes a positive share of individuals prepared to carry the costs of enforcement in the interests of the group (Gintis 2000; Gintis et al. 2003). This cannot be guaranteed by a capacity for moral judgement or by any other innate feature of individual cognition. The phenomenon is frequency-dependent: what I do depends crucially on what I expect others to do. Psychological experiments have shown that faced with a choice between law and lawlessness, most humans intuitively 'vote with their feet' in favour of life under the rule of law (Gürerk et al. 2006). But this preference is irrelevant unless the rule of law exists as an objectively available choice—in other words, unless sanctions are already being enforced in at least one group. Prior to this critical point, individuals who might otherwise prefer a

legal framework in their own group obstruct that outcome because they reject the inevitable payoff disadvantages of having to punish multiple miscreants themselves. All this makes it difficult to see how successful enforcement could ever have got off the ground.

It has been claimed that some wild-living apes do in fact respect group-level contracts (Savage-Rumbaugh et al. 1998, p. 218). By way of evidence, it is pointed out that adult male bonobos often stand aside while the group's females and young feed on a limited supply of food (Furuichi 1989). But it might be more parsimonious to suppose that the males in question stand aside owing at least in part to the female dominance characteristic of this species (Parish and De Waal 2000). Why, after all, would a high quality male strive to displace females from their feeding-site when the result would be to spoil its chances of competing successfully for sex? Male apparent altruism toward females in this species can probably best be explained as a costly and therefore honest signal of quality as a mate (cf. Gintis et al. 2001).

When brown capuchin monkeys were given payoffs in one another's presence, they rejected valuable food items and opportunities for profitable exchange on perceiving that rivals had previously been offered a better deal. This seems to indicate that monkeys have a sense of fair play (Brosnan and de Waal 2003). Hauser (1992) reports captive rhesus monkeys actively punishing conspecifics who had kept silent about discovered food instead of advertising it with a call. Monkeys who tried to cheat in this way received so much aggression when caught that they managed to consume on average only a fraction of the food they could have expected by following an honest strategy of emitting food calls.

All this suggests that primates make judgements and act on impulses in ways that could have led humans toward the rule of law. However, we should not exaggerate the significance of such findings. Psychological mechanisms of envy and levelling are only to be expected in association with strategies of vigilant sharing in which relative values loom larger than absolute ones. It is interesting that monkeys 'demand equal pay', but there is no evidence that in the wild they could construct a social order on that basis. Hauser's rhesus monkeys are not punishing deceitful feeders in the interests of the community as a whole—on the contrary, their aggression is clearly aimed at securing food for themselves. If there is any element of punishment beyond that requirement, it can be interpreted as a self-interested strategy through which honest signallers inhibit silent feeders from enjoying fitness advantages at their expense (cf. Price et al. 2002). Primate moral impulses, in short, are certainly relevant to the challenge of explaining the uniquely human political ability to enforce moral norms through coercive institutional means (Boehm 2001). But psychological mechanisms are one thing, stable institutional outcomes quite another.

How, then, did human evolution culminate in institutionally enforced moral regulation of sexual, economic and other behaviour? Some scholars have been tempted to minimize the theoretical difficulties by setting out from a problematic initial assumption: norms for cooperation and altruistic punishment have *already* emerged within a given social group. Once defection by insiders is rare, altruistic punishers can expect to face correspondingly few challenges—whereupon otherwise

weak evolutionary forces such as payoff-biased cultural transmission ('imitate the successful') and conformist transmission ('imitate what is currently fashionable') can start to stabilize enforcement strategies. Owing to the advantages enjoyed by a well-regulated group relative to an unregulated one, the otherwise weak force of group selection might then come into operation. Finally, genes favouring the new law-abiding strategies might confer fitness by decreasing their bearers' chances of suffering costly punishment (Henrich and Boyd 2001).

Any factor that suppresses within-group phenotypic variation and competition will automatically enhance the relative significance of between-group variation and competition. Let us suppose, for example, that evolution did lead to a situation in which human sexual choices and behaviour were limited by coercively enforced moral norms, thereby reducing internal reproductive differentials. One result might have been to foster the evolution of genes favouring behaviour costly to individuals yet beneficial to the group (Boehm 2001). On this basis, Gintis et al. (2003) offer a model in which human cooperative norms and corresponding innate capacities co-evolve with distinctively human institutional arrangements.

The problem with such models is their abstract quality and corresponding circularity. Each sets out from a set of arbitrary assumptions. Too often, the central one is that group level morality already exists. How might we begin to put Darwinian flesh on the bare bones of models of this kind? Since reproductive levelling is a central feature (Bowles 2006), it would seem logical to give pride of place to sex and reproduction. Curiously, however, the most prominent theorists have for the most part contented themselves with unisex accounts (e.g., Erdal and Whiten 1994, 1996; Boehm 2001; Boyd and Richerson 1992; Henrich and Boyd 2001; Gintis et al. 2003; Nowak and Sigmund 2005). Researchers sometimes defend such imaginary conditions as simple idealizations of the kind inevitable in any science. In a Darwinian context, however, the argument is simply nonsense: to exclude sex and reproduction is to exclude everything that matters most.

An exception to the unisex rule was Catherine Key (Key and Aiello 1999, 2000), who conducted Prisoners' Dilemma simulations involving both male and female agents. She found that under certain conditions, males choose to co-operate with females even when reciprocation is absent or uncertain. For this to occur, female energetic costs of reproduction must be much higher than those for males. Secondly, females must be able to exclude uncooperative males from future cooperation. Females in this model value males as sources of mating effort. In pursuit of male provisioning energies, they must offer chances of fertile sex but do not have to offer paternity certainty. Given such assumptions, the model predicts that males will invest in the current partner on condition that this does not jeopardize their ability to mate with at least one other female.

Let us assume that during the course of human evolution, group-on-group competition favoured increased group size, intensifying selection pressures for alliance building, political scheming and therefore for enhanced social intelligence. As mothers came under pressure to produce correspondingly large-brained offspring, their reproductive costs increased. Birth had to occur when infants were

relatively undeveloped, intensifying and extending the duration of maternal dependency (Martin 1990; Foley and Lee 1991). How did human mothers succeed in meeting these new reproductive costs?

Early *Homo* females may have met such challenges through increased body size, more efficient locomotion and increased reliance on close kin including post-reproductive mothers (Power and Aiello 1997; O'Connell et al. 1999, 2002; Knight and Power 2005). But from half a million years ago, when brain size began increasing dramatically, new strategies would have been required. One suggestion is that during this critical evolutionary period, females began cooperating preferentially with males willing to hunt at a distance and bring meat to camp. For this strategy to succeed, females had to develop alliances strong enough to impose a boycott on males tempted to compete for sex through techniques involving actual or threatened violence. Such strategies might have proved evolutionarily stable on condition females could raise the costs imposed on behaviourally dominant males to a level high enough to outweigh any likely benefits. In this model, females outside the coalition—that is, those choosing to collude with behavioural dominance in males—risk abandonment by their unfaithful mates and being left alone to raise their offspring (Power and Aiello 1997; Key and Aiello 2000).

In this model, the rule of law reduces to one fundamental fact: the ability of females to collectively punish uncooperative males (cf. Knight 1991; Knight et al. 1995). Males are rewarded when they re-deploy their fighting abilities, making use of muscular strength and weaponry not for purposes of interpersonal violence but instead in cooperative hunting. Males continue to compete for access to fertile females, but success in asserting behavioural dominance no longer translates into reproductive success (Knauft 1991). Males now have no choice but to compete to be perceived in female eyes as generous and productive hunters (cf. Hawkes 1990a, b, 1993, 1996). When economic exploitation works this way round—that is, with females economically exploiting non-kin males rather than being exploited by them—long-term political stability becomes less problematic. Darwinian 'selfish gene' theory (Dawkins 2006 [1976]) explains why males should mount little resistance to the rule of law in this particular form: if hunters are being exploited economically by their pregnant or nursing spouses, they must have a good chance of being exploited indirectly by their own genetic offspring. We expect males to collude with anything that enhances their own genetic fitness. We therefore expect law-enforcement in this particular form to prove stable as an evolutionary strategy.

5 An ideal speech community

Imagine a non-Machiavellian world—one without behavioural conflicts, inequalities or corresponding power struggles. The idea is patently unrealistic. Yet one of the most characteristic simplifying assumptions of twentieth century linguistic theory is precisely that of a 'homogenous speech community'. The term 'homogenous' is Chomsky's (1965, p. 3), but the underlying idea can be traced

back to Durkheim ([1965](1965) [1912]) and Saussure ([1974](1974) [1915]). For understandable reasons, linguists have assumed interaction on a civilized plane—'a level playing field', to adopt the appropriate cricketing metaphor. Sending a message, in Saussure's conceptual universe, was very like going to the post office: one must correctly address the envelope and affix the right stamp. Anticipating Wittgenstein ([1968](1968); see discussion in Harris [1988](1988)), Saussure likened language in its systematic aspect to an artificial board game such as chess.

Let us recall Chomsky's ([1965](1965), p. 3) original formulation:

Linguistic theory deals primarily with an ideal speaker–listener, in a completely homogeneous speech-community, who knows its language perfectly and is unaffected by such grammatically irrelevant conditions as memory limitations, distractions, shifts of attention and interest, and errors (random or characteristic) in applying his knowledge of the language in actual performance.

Bourdieu ([1991](1991), p. 430) dismissed this set of assumptions as ideological—'the illusion of linguistic communism'. To be fair, Chomsky offered it as no more than a theoretical model, not to be confused with reality. Yet we still need to know why *this particular* unrealistic assumption should be theoretically required.

Is the notion of a 'completely homogenous speech community' consistent with Darwinian first principles? To most evolutionary biologists, it would seem utterly inconsistent. No one has ever suggested that wild-living apes or monkeys collectively invent or evolve board games, formal kinship structures or any other kinds of 'institutional facts' (Chase [1999](1999); Searle [1996](1996); Runciman [2001](2001)). Whether individually or in groups, non-humans reciprocally influence one another's strategies and behaviour. But all animals inhabit what is ultimately an unregulated—that is, a straightforwardly Darwinian—world. In such a world, language not only fails to evolve. It is not even theoretically possible.

6 In defence of Darwinism

Institutional reality is not Darwinian, yet Darwinism must be used to explain it. I am here exploring the possibility that language evolved as an *internal feature* of life conducted under the rule of law. The idea can be traced back to sociological classics such as Rousseau's ([1973](1973) [1762]) *The Social Contract* or Durkheim's ([1965](1965) [1912]) *The Elementary Forms of Religious Life*. But Rousseau and Durkheim were not under pressure to face the challenges posed by modern Darwinism.

In asking how society first became established, the social anthropologist Ernest Gellner sets out from 'the most famous, but least tenable' theory available, namely classical eighteenth century social contract theory. Gellner ([1988](1988), p. 130) readily admits that Rousseau's version is fatally flawed:

The objection to the social contract theory is of course that it is patently, brazenly, obviously circular. It presupposes the very thing which it is meant to explain, namely the existence of a contract-capable being, a being, that is to

say, with the ability to conceptualize a situation distant in time and abstractly specified, and effectively to bind himself to behave in a certain kind of way if and when that situation arises.

But, Gellner continues, those who simply ridicule Rousseau would do better to make use of the light he throws on what is distinctive about human society.

The key distinguishing feature is contractual obligation. Gellner (1988, p. 130) at this point invokes Durkheim, summarizing as follows the role played by ritual in the sociological theory of religion:

> The way in which you restrain people from doing a wide variety of things, not compatible with the social order of which they are members, is that you subject them to ritual. The process is simple: you make them dance round a totem pole until they are wild with excitement, and become jellies in the hysteria of collective frenzy; you enhance their emotional state by any device, by all the locally available audiovisual aids, drugs, dance, music and so on; and once they are really high, you stamp upon their minds the type of concept or notion to which they subsequently become enslaved.

For Durkheim, then, the central feature of religion is ritual, and its role is to endow individuals with compulsive concepts capable of fostering moral conduct.

Building on Rousseau, Durkheim and Gellner, the Darwinian theorists John Maynard Smith and Eörs Szathmáry (1995) treat the establishment of contract-based society as one among a number of 'major transitions'—shifts between one level of organizational complexity and another—punctuating the history of life on earth. But they note that we still lack a Darwinian explanation for rituals of the necessary kind. They accept that 'cultural group selection' (Boyd and Richerson 1985) may have favoured ceremonies effective in producing community-wide cohesion. As they explain:

> If a human group is successful because of its system of ritual, this has two effects: by cultural evolution, it causes the spread of a particular set of beliefs, and by genetic selection it favours individuals who can be strongly influenced by those beliefs (and probably by any other ritually enforced beliefs). In other words, there is between-group selection for culturally inherited systems of belief that favour the success of groups, and there is individual selection for the genetically inherited ability to be influenced by ritual (Maynard Smith and Szathmáry 1995, pp. 272–273).

None of this, however, addresses the basic mystery—why, when or how evolving humans arrived at the point of inculcating religious fictions by ritual means. As Maynard Smith and Szathmáry conclude (1995, p. 272),

> it is still unclear why the inculcation of proper behaviour is achieved by ritual and myth rather than by explicit precepts... It is easy to say that ritual is effective in creating an emotional commitment to a set of beliefs... but that is to describe a state of affairs rather than to explain it.

7 Community life: 'homogenous' or Darwinian?

Totemic rituals aside, trust founded on contractual commitment certainly pervades human social life, playing a key role in friendship, love, kinship and most forms of social and economic exchange (Kosfeld et al. 2005; Zak and Knack 2001). The rule of law creates a climate of trust (Stompka 1999). Although competition is not abolished, it assumes a different form: it must proceed within the law. A reputation for trustworthiness cannot be extracted by Machiavellian manipulation or material inducements: it must be earned. If the human species has come to occupy 'the cognitive niche' (Tooby and DeVore 1987), it is owing to the fact that status competition takes this form. Humans are under competitive pressure to prove to one another how knowledgeable they are, struggling to be perceived as sources of relevant information (Dessalles 1998). This necessarily entails viewing oneself from the standpoint of others, coordinating personal perspectives with wider social aims and in key respects adopting what might be termed a 'god's eye' view of the world (Boyer 2001). To prove capable and worthy of such responsibility and vision, it is necessary to show commitment in some convincing and reliable way (Irons 2001; Alcorta and Sosis 2005; Atran 2002). Only in passing through the relevant rite of passage (Van Gennep 1960 [1909]) do group members become accepted as responsible agents whose words are not empty sounds but 'carry weight' (Bourdieu 1991; Power 2000; Rappaport 1999).

When perspectives are shared in this way and levels of trust become correspondingly high, communication can prove effective even without language. A barely perceptible wink can 'speak volumes' on one condition: shared understandings must already be well entrenched. A nod may be regarded as a rudimentary 'up/down' switch; a wink is closer to 'on/off'. It is immediately clear that digital switches of this kind presuppose trust: two parties engaged in a violent argument could not conceivably communicate in so effortless a way.

8 A thought experiment

Imagine you are driving a vehicle in a congested city. As your journey starts, the traffic lights appear to be functioning normally, as do your vehicle's left and right indicators, brake lights, dipswitches and so forth. All motorists are equal: in the eyes of the law, a large vehicle has no more privileges than the smallest one. Society is 'homogenous' in this narrow yet vital sense: the same red light at a junction means 'stop' for everyone in exactly the same way.

But now you notice that somewhere ahead of you the traffic lights have failed. Vehicles of all shapes and sizes are piling up, contesting every available space. No one gives way; nothing moves. Your cognitive faculties remain intact, but your customary driving skills no longer work. Pressing buttons to indicate 'right' or 'left' is now a waste of time. It is not that the world has become cognitively deficient. It is simply that civilization has temporarily collapsed. If you want people to make way, there is only one solution—abandon subtleties and deploy the whole vehicle, pushing, threatening and nudging your way through. Size once again matters.

Unless you are prepared to risk colliding—daring others to weigh up the costs and benefits of mounting a challenge—you may remain in the same spot for quite some time.

When chimpanzees vocalize in the wild, they deploy the whole vehicle. Pant hoots and waa barks are 'body language' in this fundamental sense—they are hard-to-fake indices of real bodily and emotional states. To produce an impact in a Darwinian world, signallers must abandon low-cost subtleties and invest the body in establishing each and every point. This is the essence of what is termed 'the handicap principle' governing communication in the animal world. Commercial banks and insurance companies follow the same principle when they erect extravagant skyscrapers demonstrating how much money they can afford to waste. The most convincing advertisement is always a handicap so burdensome that competitors are simply unable to afford it (Zahavi 2003, p. 860).

Since 1990, this principle has been generally accepted as a valid way of explaining how animal signals evolve (Grafen 1990a, b). Even so, many scholars still believe that the principle has only limited validity. Signals, it is sometimes claimed, need not be reliable when the communicating parties are co-operating. But as Zahavi (1993, 2003) points out in reply, the fact is that nature has no place for pure conventions—that is, for signs lacking any causal basis for their meanings. The explanation is simple. In nature there is an *inherent* conflict among *all* social partners including mates (Williams 1966), parents with offspring (Trivers 1974) and members of any social group (Dawkins 2006 [1976]). No individual can be sure at any particular moment whether or not there is a conflict of interest between it and any particular collaborator, whether related or unrelated. To be on the safe side, it is best to ignore all *potentially* deceptive signals. Arbitrary conventions fall into this suspect category—they are like banknotes without even any visible watermark. That explains why they do not evolve (Zahavi 1993).

Now let us imagine the opposite logical extreme. When two humans are playing chess, it is reasonable for each player to place unconditional trust in the other's conventional signs. 'Unconditional trust' sounds extreme: in a competitive situation we would not normally expect such trust. So let me clarify on what level trust is unconditional and on what level it cannot be. We need to distinguish between obediently conforming to the rules of the game and imaginatively exploiting those rules in order to win. On the imaginative level of the game as it unfolds, Machiavellianism is to be anticipated. On this level, for obvious reasons, neither player should be too trusting of what the other might have in mind. But despite this, the validity of any given move should not be in doubt. In a game of this kind, a physical move *does not count as a move* without joint attention, mutual recognition and agreement between the parties involved. Trust is unconditional because cheating is impossible on that fundamental level. No matter how Machiavellian, no player can make one move on the board while doing something else behind the scenes. A player concealing a movement under the table, for example, would accomplish nothing: the game is restricted to what occurs transparently on the board.

Pondering a difficult move may require time and in that sense some cost. But selecting between two alternative moves is not measurable in terms of any energetic difference between them. While performance is always costly, intentions in

themselves cost nothing—and accomplishing a move presupposes no more than ensuring recognition of its underlying intention. If we accept that language works in essentially the same way (Austin 1978 [1955]; Harris 1988; Wittgenstein 1968; Sperber and Wilson 1986), it becomes clear why speech acts, unlike animal vocal or other displays, can produce their effects at apparently zero cost.

Nothing remotely like this is possible in the animal world. Admittedly, signals in nature may be more or less energetically demanding. Among primate juveniles during their playful games, for example, gestural displays can be imaginative, inconsequential and correspondingly undemanding in energetic terms. In the absence of competitive pressure, signalling costs may be quite low. Incipiently conventionalized gestural shorthands on the model of the chimpanzee infant 'nursing poke' (Tomasello et al. 1994) may begin to emerge as and where mutual trust is high (Knight 2000; Searcy and Nowicki 2005). But the existence of *relatively* cheap body language does not alter the fundamental fact: zero-cost digital conventions are not found. Wherever outcomes might have fitness consequences, displays must take the form of material investments to be evaluated on an analog scale (Zahavi and Zahavi 1997).

9 Intersubjectivity and reverse status allocation

Michael Tomasello (1999) identifies distinctively human 'mind' with a specific, quite remarkable level of social cognition. No ape is capable of bi-directional mind reading. Apes don't point at things; humans from an early age do. It is as if no ape ever asked of another, 'Do you see what I see?' This failure to *correlate perspectives* is related to another characteristic: even as they mature and become socially aware, apes have great difficulty viewing themselves as if through one another's eyes. Whether as cause or consequence of this social deficit, they find it difficult to reflect back on their own mental states, distinguishing these from the mental states of those around them. Apes, in short, are incapable of what Tomasello calls 'intersubjectivity'.

It would be a mistake to ascribe this to bad evolutionary design. In its own competitive world, why should an ape identify emotionally or in other ways with its actual or potential rivals? In agonistic contexts, allies are valued for their fighting prowess and talents at Machiavellian scheming. Primate status and corresponding fitness advantages (Cowlishaw and Dunbar 1991; Ellis 1995) depend less on earning peer esteem than on exercising dominance through threat or force. Admittedly, impulses that strike human observers as incipiently moral do have a place, as De Waal (1996) has been at pains to show. But a consistently honest, open, trusting and responsible ape would not get far in life.

Like other primates, humans are by nature Machiavellian—that is, they co-operate or cheat according to perceived need. But human status competition—in hunter–gatherer societies at least—follows a logic in key respects the reverse of that characteristic of other primates (Brody 2000). Although cheating and intimidation occasionally pay, the winning formula over the long term is to strive for perceived excellence in socially valued domains (Henrich and Gil-White 2001).

Where direct behavioural conflict is suppressed, humans have no choice but to compete in this paradoxical way, striving for moral standing by proving self-effacing, honest and cooperative in one another's eyes. The best strategy is to identify oneself as a morally responsible being, living up to that standard insofar as conditions permit.

10 The stabilization of reverse dominance

The 'female cosmetic coalitions/sex strike' model of human origins (Knight 1991; Knight et al. 1995; Power and Aiello 1997) shows how 'reverse dominance' (Boehm 2001) may have evolved as an emergent outcome of female resistance to the fitness costs of philandering by dominant males. To gain fitness benefits from philandering, males must obtain information allowing them to target imminently fertile females, minimizing time spent with already pregnant or nursing ones. As a biological signal, menstruation offers philanderers this kind of information. But no human female has an interest in allowing a male to get her pregnant only to leave her alone with the baby, her former partner meanwhile impregnating a string of additional females as these become fertile in their turn. To counter this risk, current and future mothers—whether related or unrelated—would be predicted to cooperate in mounting resistance. According to the Darwinian line of argument I support (cf. Power and Aiello 1997), this is where 'reverse dominance' (Boehm 2001) starts and where the 'human revolution' (cf. Mellars and Stringer 1989; Watts 1999) correspondingly begins.

If we accept that success in philandering entails actively monitoring and discriminating between females on the basis of their biological displays, then it is not difficult to predict the corresponding female counter-strategy. The relevant signals must be scrambled. There might be many ways of doing this, but a universal theme can be predicted: obliterate the distinction between fertile and non-fertile females. Since menstruation marks precisely this distinction, it cannot be left in its biological form. Its message must be packaged in some artificial way. If dances are performed, we expect gender solidarity. If songs are sung, we expect teasing and laughter at the expense of males. If cosmetics are used, we expect blood reds. Combining these predictions, we expect ritual performances in which cycling females are rendered both cosmetically and physically inseparable from a well-organized reverse dominance collective.

Although controversial, this model does have advantages over its rivals. Claude Lévi-Strauss (1969) argued that the first moral regulation was the culturally enforced incest taboo. He offered a sociological explanation: without sister-avoidance and hence 'the exchange of women', solidarity between neighbouring groups of men could never have been maintained. Marshall Sahlins (1960) offered a similar proposal: the primate ancestors of *Homo sapiens* were selfish and competitive, but then culture dramatically intervened, suppressing ancient instincts and establishing 'morality' over 'might'. The archaeologist Philip Chase (1999) uses an essentially similar argument: symbolic culture just had to emerge because there was no other way to enforce 'co-operation between strangers'. More in

keeping with Darwinism is the hypothesis of hunter–gatherer-style 'counter-dominance' becoming established through 'Machiavellian status escalation'. In this scenario, everyone seeks to dominate while striving simultaneously to avoid being dominated—leading to a stalemate in which egalitarianism prevails simply because the costs of dominance are now too high (Erdal and Whiten 1994, 1996). Christopher Boehm (2001) goes beyond stalemate to revolution. The crucial transition in his view was the revolutionary overthrow of dominance and its replacement by 'reverse dominance'—the supremacy of the community acting as a whole. But in this case as in all the others, suggesting such an event falls short of explaining it in Darwinian terms.

None of the above models explains why male dominance associated with sexual philandering should be a stable strategy in primates while becoming less and less stable during the course of human evolution. By contrast, the 'female cosmetic coalitions/sex strike' model links reverse dominance to the rising costs to human mothers of producing and nurturing infants with increasingly large brains. Potential test data concerning group sizes, foraging ranges, subsistence strategies and reproductive strategies can be derived indirectly from cranial volumes, tooth eruption schedules and similarly well-documented features of the fossil record of human evolution (Aiello and Dunbar 1993; Aiello and Wheeler 1995; Power and Aiello 1997). Resistance to philandering would make no sense unless females needed their male partners to invest time and resources in offspring subsequent to impregnation. Again unlike its rivals, the model proposed here addresses this issue by factoring in the distinctively human requirement for males to invest time and energy in bringing home provisions to heavily child-burdened mothers.

Finally, the model makes detailed predictions testable in the light of ethnographic, archaeological and other data. Let us accept, with Boehm (2001), that as human evolution culminated in the establishment of reverse dominance, a coalition embracing everyone began imposing its authority, outlawing dominance by any particular individual or sectional alliance. Boehm chooses to ignore the role of sex in all this, but we need not follow him in this unhelpful simplification. Restoring sex to the picture enables us to predict how reverse dominance should assert itself in terms of bodily imagery and display. On purely theoretical grounds, what constraints or regularities should we expect?

We know that a roving Darwinian male must discriminate in favour of a potential mate displaying that she is of the right (same) species, of the right (opposite) sex and in her right (fertile) period. The reverse on every count—'*wrong species; wrong sex; wrong time*'—is therefore the predicted signature of 'reverse dominance' or 'sex-strike' (Knight et al. 1995). Is this prediction borne out? It is well known that tricksters, shape-changers, totems and similarly ambivalent entities are central to hunter–gatherer representations of sacred authority, here termed 'the rule of law'. The essence of such entities is that they are split representations: a female who is simultaneously male, an animal who is simultaneously human, a wounded or bleeding ancestor who is very much still alive. In Aboriginal Australia, the image of the rainbow snake unites male and female, life and death, animal and human in very much the predicted way (Knight 1991). The same can be said of African hunter–gatherer figures such as the Hadza 'Woman with the Zebra's Penis' or Kalahari

Bushman 'Eland Bull/New Maiden' (Power and Watts 1997; Watts 2005). To sum up: hunter–gatherer religious representations are 'totemic'. Ritual and mythic potency is conveyed via animal–human ambivalence, gender-ambivalence and a blurring of the boundary between the living and the dead. Rather than pile up supportive evidence, however, it may be more persuasive to state the model's testability in reverse. To falsify it, critics must be able to point to hunter–gatherer representations of sacred phenomena that violate the predicted ambivalence in terms of gender, species and/or time. To date, no such counterevidence has been claimed.

11 Conclusion

The 'human revolution' culminated in something remarkable—the establishment of the rule of law. Apes do not recognize group level social contracts. Contractual reality does not exist for them. When they signal, consequently, they must intervene in physical and biological reality. There is no other kind of reality in which they *can* intervene. Each animal can make a difference only physically, only with its body— with signals inseparable from the 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'. Entities such as underworlds, totemic spirits and promises exist insofar as it is collectively believed that they do (Searle 1996). A speech act, like a move in a game of 'let's pretend', is internal to reality of this kind. A move need produce no physical or biological impact—only a shift in perspective. Each such change of state occurs within a quite peculiar domain, neither objective nor subjective in the ordinary sense. Things are 'seen' or 'judged' differently, and *to that extent* reality (the world as jointly constructed) has changed.

When human life became subject to the rule of law, participation in this kind of reality became possible for the first time. Because signals internal to this novel domain were no longer evolving in a Darwinian world, the familiar laws of signal evolution (Dawkins and Krebs 1978; Krebs and Dawkins 1984) no longer applied. Intrinsic reliability was no longer a requirement, allowing zero-cost signalling to emerge. Among other consequences, messages could now be encoded as digital shorthands. Thanks to this remarkable development, abstract principles such as recursion—formerly restricted to internal cognition—could now for the first time find expression in public language. The former paradoxes of language evolution correspondingly dissolved.

No one today doubts Chomsky's claim that the language faculty is a component of human nature. But respect for the law cannot be explained by this or that instinct, hormone, cognitive module or postulated gene. Where behavioural strategies provoke counter-strategies, contrasting strategic outcomes must necessarily emerge on the basis of identical genes. Only once a new strategy has become evolutionarily stable does this in turn alter selection pressures, modifying the trajectory of subsequent genetic evolution.

The law cannot be imposed partially or half-heartedly—it must prevail decisively if it is not to be subverted and overthrown. In that sense, our hunter and gatherer ancestors cannot have won the revolution step by imperceptible step. At a certain point, once conditions were ripe, they established the rule of law in the only way they could. For those concerned, it would have been all or nothing. In one small population at least, resistance to lawlessness eventually succeeded—and turned the world upside down (Mellars and Stringer 1989; Maynard Smith and Szathmáry 1995; Boehm 2001).

Language is dependent on civilized, 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.

References

Aiello LC, Dunbar RIM (1993) Neocortex size, group size, and the evolution of language. Curr Anthropol 34:184–193

Aiello LC, Wheeler P (1995) The expensive tissue hypothesis: the brain and the digestive system in human and primate evolution. Curr Anthropol 36:199–221

Alcorta CS, Sosis R (2005) Ritual, emotion, and sacred symbols: the evolution of religion as an adaptive complex. Hum Nat 16(4):323–359

Atran S (2002) In gods we trust: the evolutionary landscape of religion. Oxford University Press, Oxford

Austin JL (1978 [1955]) How to do things with words. Oxford University Press, Oxford

Axelrod R (1986) An evolutionary approach to social norms. Am Polit Sci Rev 80:1095–1111

Boehm C (2001) Hierarchy in the forest: the evolution of egalitarian behavior. Harvard University Press, Cambridge

Botha R (2003) Unravelling the evolution of language. Elsevier, Oxford

Bourdieu P (1991) Language and symbolic power. Polity Press, Cambridge

Bowles S (2006) Group competition, reproductive levelling, and the evolution of human altruism. Science 314:1569–1572

Boyd R, Richerson PJ (1985) Culture and the evolutionary process. University of Chicago Press, Chicago

Boyd R, Richerson PJ (1992) Punishment allows the evolution of cooperation (or anything else) in sizeable groups. Ethol Sociobiol 13:171–195

Boyer P (2001) Religion explained. Basic Books, New York

Brody H (2000) The other side of Eden: hunters, farmers and the shaping of the world. North Point Press, New York

Brosnan SF, de Waal FBM (2003) Monkeys reject unequal pay. Nature (Ldn) 143:297–299

Brown P, Levinson SC (1987 [1978]) Politeness: some universals in language usage. Cambridge University Press, Cambridge

Burling R (2005) The talking ape: how language evolved. Oxford University Press, Oxford

Chase P (1999) Symbolism as reference and symbolism as culture. In: Dunbar RIM, Knight C, Power C (eds) The evolution of culture. Edinburgh University Press, Edinburgh, pp 34–49

Chomsky N (1965) Aspects of the theory of syntax. MIT Press, Cambridge

Chomsky N (1988) Language and problems of knowledge: The Managua lectures. MIT Press, Cambridge

Chomsky N (1995) The minimalist programme. MIT Press, Cambridge

Cowlishaw G, Dunbar RIM (1991) Dominance rank and mating success in male primates. Anim Behav 41:1045–1056

Dawkins R (2006 [1976]) The selfish gene, 30th anniversary edn. Oxford University Press, Oxford

Dawkins R, Krebs JR (1978) Animal signals: information or manipulation? In: Krebs JR, Davies NB (eds) Behavioural ecology: an evolutionary approach. Blackwell Scientific Publications, Oxford, pp 282–309

De Waal FBM (1996) Good natured: the origins of right and wrong in humans and other animals. Harvard University Press, Cambridge

Dessalles JL (1998) Altruism, status and the origin of relevance. In: Hurford JR, Studdert-Kennedy M, Knight C (eds) Approaches to the evolution of language. Cambridge University Press, Cambridge, pp 130–47

Dunbar RIM (1988) Primate social systems: studies in behavioural adaptation. Croom Helm, London

Dunbar RIM (1999) Culture, honesty and the freerider problem. In: Dunbar RIM, Knight C, Power C (eds) The evolution of culture: an interdisciplinary view. Edinburgh University Press, Edinburgh, pp 194–213

Durkheim E (1963 [1898]) La prohibition de l'inceste et ses origins. Année Sociol 1:1–70. (Reprinted as Incest: the nature and origin of the taboo, trans E Sagarin. Stuart, New York)

Durkheim E (1965 [1912]) The elementary forms of the religious life. Free Press, New York

Ellis L (1995) Dominance and reproductive success among nonhuman animals: a cross-species comparison. Ethol Sociobiol 16:257–333

Engels F (1972 [1884]) The origin of the family, private property and the state. Pathfinder Press, New York

Enquist M, Leimar O (1993) The evolution of cooperation in mobile organisms. Anim Behav 45:747–757

Erdal D, Whiten A (1994) On human egalitarianism: an evolutionary product of Machiavellian status escalation? Curr Anthropol 35(2):175–183

Erdal D, Whiten A (1996) Egalitarianism and Machiavellian intelligence in human evolution. In: Mellars P, Gibson K (eds) Modelling the early human mind. McDonald Institute Monographs, Cambridge

Flack J, Girvan M, de Waal FBM, Krakauer DC (2006) Policing stabilizes construction of social niches in primates. Nature (Ldn) 439:426–429

Foley RA, Lee PC (1991) Ecology and energetics of encephalization in hominid evolution. Phil Trans R Soc Ldn 334:223–232

Fouts RS (1975) Capacities for language in great apes. In: Tuttle RH (ed) Socioecology and psychology of primates. Mouton, The Hague, pp 371–390

Fouts RS (1997) Next of kin: my conversations with chimpanzees. Harper Collins, New York

Furuichi T (1989) Social interactions and the life history of female *Pan paniscus* in Wamba, Zaire. Int J Primatol 10(3):173–197

Gellner E (1988) Origins of society. In: Fabian AC (ed) Origins: the Darwin college lectures. Cambridge University Press, Cambridge

Gintis H (2000) Strong reciprocity and human sociality. J Theor Biol 206:169–179

Gintis H, Alden Smith E, Bowles S (2001) Costly signalling and cooperation. J Theor Biol 213:103–119

Gintis H, Bowles S, Boyd R, Fehr E (2003) Explaining altruistic behaviour in humans. Evol Hum Behav 24:153–172

Grafen A (1990a) Sexual selection unhandicapped by the Fisher process. J Theor Biol 144:473–516

Grafen A (1990b) Biological signals as handicaps. J Theor Biol 144:517–546

Grice HP (1989) Studies in the way of words. Harvard University Press, Cambridge

Gürerk Ö, Irlenbusch B, Rockenbach B (2006) The competitive advantage of sanctioning institutions. Science 312:108–111

Hamilton WD (1964) The genetical evolution of social behaviour I, II. J Theor Biol 7:1–52

Harris R (1988) Language, Saussure and Wittgenstein: how to play games with words. Routledge, London/New York

Hauser MD (1992) Costs of deception: cheaters are punished in rhesus monkeys. Proc Natl Acad Sci USA 82:12137–12139

Hauser MD, Chomsky N, Fitch WT (2002) The faculty of language: what is it, who has it, and how did it evolve? Science 298:1569–1579

Hawkes K (1990a) Showing off: tests of an hypothesis about men's foraging goals. Ethol Sociobiol 12:29–54

Hawkes K (1990b) Why do men hunt? Some benefits for risky strategies. In: Cashdan E (ed) Risk and uncertainty. Westview Press, Boulder Colarado, pp 145–166

Hawkes K (1993) Why hunter–gatherers work: an ancient version of the problem of public goods. Curr Anthropol 34:341–361

Hawkes K (1996) Foraging differences between men and women: behavioural ecology of the sexual division of labour. In: Steele J, Shennan S (eds) The archaeology of human ancestry: power, sex and tradition. Routledge, London, pp 283–305

Henrich J, Boyd R (2001) Why people punish defectors: weak conformist transmission can stabilize costly enforcement of norms in cooperative dilemmas. J Theor Biol 208:79–89

Henrich J, Gil-White FJ (2001) The evolution of prestige: freely conferred deference as a mechanism for enhancing the benefits of cultural transmission. Evol Hum Behav 22:165–196

Henrich J, McElreath R, Barr A, Ensminger J, Barrett C, Bolyanatz A, Cardenas J, MGurven M, Gwako E, Henrich N, Lesorogol C, Marlowe F, Tracer D, Ziker J (2006) Costly punishment across human societies. Science 312:1768–1770

Irons W (2001) Religion as a hard-to-fake sign of commitment. In: Nesse R (ed) Evolution and the capacity for commitment. Russell Sage, New York, pp 292–309

Key CA, Aiello LC (1999) The evolution of social organisation. In: Dunbar RIM, Knight C, Power C (eds) The evolution of culture. Edinburgh University Press, Edinburgh, pp 15–33

Key C, Aiello LC (2000) A prisoner's dilemma model of the evolution of paternal care. Folia Primatol 71:77–92

Knauft BB (1991) Violence and sociality in human evolution. Curr Anthropol 32:391–428

Knight C (1991) Blood relations: menstruation and the origins of culture. Yale University Press, New Haven/London

Knight C (2000) Play as precursor of phonology and syntax. In: Knight CD, Studdert-Kennedy M, Hurford JR (eds) The evolutionary emergence of language: social function and the origins of linguistic form. Cambridge University Press, Cambridge, pp 99–119

Knight C, Power C (2005) Grandmothers, politics, and getting back to science. In: Voland E, Chasiotis A, Schienfenhövel W (eds) Grandmotherhood: the evolutionary significance of the second half of female life. Rutgers, New Brunswick, pp 81–98

Knight C, Power C, Watts I (1995) The human symbolic revolution: a Darwinian account. Camb Archaeol J 5:75–114

Kosfeld M, Heinrichs M, Zak PJ, Fischbacher U, Fehr E (2005) Oxytocin increases trust in humans. Nature (Ldn) 435:673–676

Krebs JR, Dawkins R (1984) Animal signals: mind-reading and manipulation. In: Krebs JR, Davies NB (eds) Behavioural ecology: an evolutionary approach. Blackwell Scientific Publications, Oxford, pp 380–402

Lee RB (1988) Reflections on primitive communism. In: Ingold T, Riches D, Woodburn J (eds) Hunters and gatherers, vol. I: history, evolution and social change. Aldine, Chicago, pp 252–268

Leech G (1980) Language and tact. In: Explorations in semantics and pragmatics: pragmatics and beyond. John Benjamins, Amsterdam, pp 79–117

Lévi-Strauss C (1969) The elementary structures of kinship. Eyre and Spottiswoode, London

Martin RD (1990) Primate origins and evolution. Chapman and Hall, London

Maynard Smith J, Szathmáry E (1995) The major transitions in evolution. WH Freeman, New York

Mellars PA, Stringer C (1989) The human revolution: behavioural and biological perspective in the origins of modern humans. Edinburgh University Press, Edinburgh

Morgan LH (1871) Systems of consanguinity and affinity of the human family. Smithsonian Institution, Washington

Newmeyer FJ (2003) Review article. Language 79(3):583–599

Nowak MA, Sigmund K (2005) Evolution of indirect reciprocity. Nature (Ldn) 437:1291–1298

O'Connell JF, Hawkes K, Blurton Jones N (1999) Grandmothering and the evolution of *Homo erectus*. J Hum Evol 36:461–485

O'Connell JF, Hawkes K, Lupo KD, Blurton Jones NG (2002) Male strategies and Plio-Pleistocene archaeology. J Hum Evol 43:831–872

Parish A, de Waal FBM (2000) The other 'closest living relative': how Bonobos *(Pan paniscus)* challenge traditional assumptions about females, dominance, intra- and intersexual interactions, and hominid evolution. Ann N Y Acad Sci 907:97–113

Pepperberg I (2005) An avian perspective on language evolution: implications of simultaneous development of vocal and physical object combinations by a Grey parrot *(Psittacus erithacus)*. In: Tallerman M (ed) Language origins: perspectives on evolution. Oxford University Press, Oxford, pp 239–261

Pinker S, Jackendoff R (2005) The faculty of language: what's special about it? Cognition 95:201–236

Power C (2000) Secret language use at female initiation: bounding gossiping communities. In: Knight C, Studdert-Kennedy M, Hurford JR (eds) The evolutionary emergence of language: social function and the origins of linguistic form. Cambridge University Press, Cambridge, pp 81–98

Power C, Aiello LC (1997) Female proto-symbolic strategies. In: Hager LD (ed) Women in human evolution. Routledge, New York/London, pp 153–171

Power C, Watts I (1997) The woman with the zebra's penis: gender, mutability and performance. J R Anthrop Inst 3(NS):537–560

Price M, Cosmides L, Tooby J (2002) Punitive sentiment as an anti-free rider psychological device. Evol Hum Behav 23:203–231

Rappaport RA (1999) Ritual and religion in the making of humanity. Cambridge University Press, Cambridge

Rousseau JJ (1973 [1762]) The social contract. In: Rousseau JJ (ed) The social contract and discourses, trans GDH Cole. Dent, London/Melbourne, pp 179–309

Runciman WG (2001) From nature to culture, from culture to society. In: Runciman WG (ed) The origin of social institutions. Oxford University Press, Oxford, pp 235–254

Sahlins MD (1960) The origin of society. Sci Am 203(3):76–87

de Saussure F (1974 [1915]) Course in general linguistics, trans W Baskin. Fontana/Collins, London

Savage-Rumbaugh S, Shanker G, Taylor TJ (1998) Apes, language and the human mind. Oxford University Press, Oxford

Searcy WA, Nowicki S (2005) The evolution of animal communication. Princeton University Press, Princeton/Oxford

Searle JR (1971) The philosophy of language. Oxford University Press, Oxford

Searle JR (1996) The construction of social reality. Penguin, London

Silk JB, Brosnan SF, Vonk J, Henrich J, Povinelli DJ, Richardson AS, Lambeth SP, Mascaro J, Schapiro SJ (2005) Chimpanzees are indifferent to the welfare of unrelated group members. Nature (Ldn) 437:1357–1359

Sperber D, Wilson D (1986) Relevance: communication and cognition. Blackwell, Oxford

Stompka P (1999) Trust. Cambridge University Press, Cambridge

Tomasello M (1999) The cultural origins of human cognition. Harvard University Press, Cambridge

Tomasello M, Call J, Nagell K, Olguin R, Carpenter M (1994) The learning and use of gestural signals by young chimpanzees: a trans-generational study. Primates 35:137–154

Tooby J, DeVore I (1987) The reconstruction of hominid behavioral evolution through strategic modelling. In: Kinzey WG (ed) The evolution of human behavior: primate models. State University of New York Press, Albany, pp 183–237

Trager GL (1972) Language and languages. Chandler, San Francisco

Trivers RL (1971) The evolution of reciprocal altruism. Q Rev Biol 46:35–57

Trivers RL (1974) Parent-offspring conflict. Am Zool 14:249–264

Ulbaek I (1998) The origin of language and cognition. In: Hurford JR, Studdert-Kennedy M, Knight C (eds) Approaches to the evolution of language. Cambridge University Press, Cambridge, pp 30–43

Van Gennep A (1960 [1909]) The rites of passage. Routledge & Kegan Paul, London

Watts I (1999) The origin of symbolic culture. In: Dunbar R, Knight C, Power C (eds) The evolution of culture. Edinburgh University Press, Edinburgh, pp 113–146

Watts I (2005) 'Time, too, grows on the Moon': some evidence for Knight's theory of a human universal. In: James W, Mills D (eds) The qualities of time: anthropological approaches. Berg, New York, pp 95–118

Williams GC (1966) Adaptation and natural selection: a critique of some current evolutionary thought. Princeton University Press, Princetone

Wittgenstein L (1968) Philosophical investigations, trans Anscombe GEM. Blackwell, Oxford

Zahavi A (1993) The fallacy of conventional signalling. Phil Trans R Soc Ldn 340:227–230

Zahavi A (2003) Indirect selection and individual selection in sociobiology: my personal views on theories of social behaviour. Anim Behav 65:859–863

Zahavi A, Zahavi A (1997) The handicap principle: a missing piece in Darwin's puzzle. Oxford University Press, Oxford/New York

Zak PJ, Knack S (2001) Trust and growth. Econ J 111:295–321

Zuckerman S (1932) The social life of monkeys and apes. Kegan Paul, Trench, Trubner, London