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Learning to be Human: teaching, culture and human cognitive evolution

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ABSTRACT Psychology has taken an evolutionary turn of late. This paper acknowledges the importance of adopting an evolutionary perspective in attempting to understand human cognition and development, but it suggests that the model adopted by many evolutionary psychologists is incomplete. Learning, teaching and cultural transmission play vital roles in the distinctive human life pattern, but have received inadequate attention in the literature. Drawing upon primatological, anthropological and psychological data, this paper offers an articulation of 'cultural learning', which, it is claimed, is a peculiarly accurate and resilient form of social form, made possible by the uniquely human capacity for an intersubjective engagement with the mental and intentional lives of other people. The paper discusses the character and appearance of imitative, collaborative and instructed forms of learning within early childhood, and tentatively identifies implications for child development and contemporary schooling.

Introduction

Psychologists and educationalists often distinguish between individual and social learning, and this division seems to inform a great deal of educational practice. This paper suggests that, with regard to human learning, this is an incomplete picture. *Cultural learning*, it is argued, plays a fundamentally important role in human development. Drawing upon a range of disciplines, such as developmental psychology, primatology and anthropology, the paper proposes a model of human cultural learning, within an evolutionary frame, and explores the relationship between this cultural learning and childhood education.

This paper is part of a much wider research project seeking to examine the implications of evolutionary theory for the social sciences related to education and childhood. It seems fair to say that researchers in these fields are often antagonistic to the other's perspective, and that this antagonism reflects a more general tension between social and natural scientists with regard to their interpretations of the human condition. On the one hand, the evolutionists often seem to believe that social and cultural processes can be explained satisfactorily in terms of biological explanations (see Wilson, 1975; Tooby & Cosmides, 1992). On the other hand, many social scientists respond that biological explanations are simply incapable of helping us to understand the richness and diversity of human existence (see the contributions to Rose & Rose, 2000; Freese, 1994).

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It is becoming increasingly apparent that neither of these extreme positions is very helpful, since any theory of human behaviour and cognition that fails to acknowledge BOTH that human evolutionary past is of great relevance to understanding the present, AND that all humans are born into cultural forms of life, cannot be adequate. This paper makes an initial attempt to bridge the divide between biological and social scientific explanations of cultural learning. It does this within the context of a puzzle of human evolution, and draws together recent theoretical and empirical data from a range of disciplines.

The Puzzle of Human Cognition and Culture

Consider two statements:

> Man is a vertebrate, mammalian, and a primate animal. That is what man is, and the fact should never be lost from accounts. (Service, 1971, p. 22)

> Though human history appears somehow discontinuous from prior natural history our sense of theoretical order creates a need to comprehend it as another chapter of natural history. The difficulty has been to find a way to so comprehend it that does not reduce the themes of our chapter of natural history to those used in prior chapters. There is something genuinely new in our chapter, just as there is something genuinely new in each prior chapter. (Bullock, 1987, p. 187)

These apparently contradictory viewpoints reflect an essential tension that lies at the heart of discussions of human evolution. Both statements seem plainly true. We are, whether we like it or not, primates. Genetically, anatomically and historically, we are very close relatives of the great apes: we share something of the order of 99% of the genetic material of chimpanzees (Arnason *et al.*, 1996; Cavalieri & Singer, 1994; see Marks, 2002, for a cautionary note), which is the same degree of relatedness of tigers to lions, or horses to zebras. We are also, in very many ways, very unlike apes, having created unprecedented technologies and forms of social organisation, and, beyond that, 'new worlds—of language, of music, of poetry, of science; and the most important of these is the world of moral demands for equality. For freedom, and for helping the weak' (Popper, 1966, p. 65). Even so-called traditional hunter-gatherer societies are characterised by degrees of social and technological complexity that are entirely absent in the rest of the animal kingdom (Panter-Brick *et al.*, 2001). These are novel features, and they set human life history on a unique path.

Many theorists have attempted to explain the distinctively human evolutionary path (Tattersall, 1998; Megarry, 1995; Mithen, 1996; Miller, 2000), and all of them have to address one tricky puzzle. Figure 1 offers a simplified depiction of the time-scale of human evolution.

It is generally accepted that somewhere in Africa about 6 million years ago (mya), a new group of apes evolved, eventually leading to the bipedal apes of the genus *Australopithecus* (Klein, 1999). These apes, which in terms of brain size, body size and sexual dimorphism are nearer to contemporary apes than modern humans, are almost certainly ancestors of the *Homo* genus (which appeared around 1.6 mya), of which modern humans are the only remaining species.

The puzzle is this: 6 million years from the appearance of the genus *Australopithecus* to modern humans is a very short period for evolution to operate (Tomasello, 1999). Natural selection usually operates over enormous periods time (Dawkins, 1986; Maynard Smith, 1993), and that would seem to preclude the sorts of dramatic changes evident in humans.

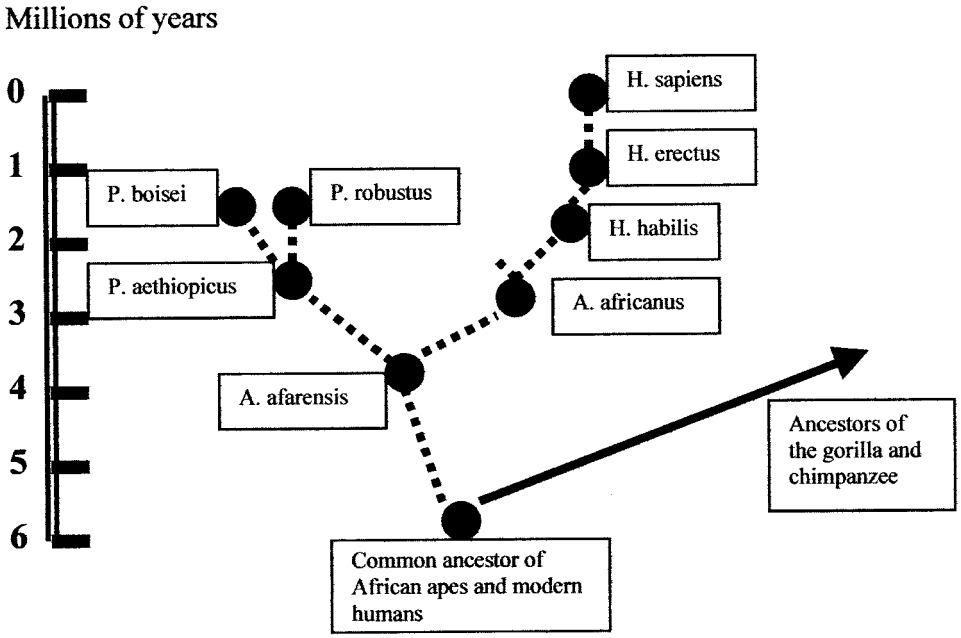

Figure 1. **Simplified possible phylogeny of the hominids (based on information from Klein, 1999 and Leakey, 2000)**

The puzzle becomes even more severe if we accept recent paleoanthropological research suggesting that for a large part of those 6 million years, the hominid lineage witnessed relatively little change at all, especially with regard to cognitive architecture (Mithen, 2000). Indeed, it is not until about 60,000 years ago that there is any consistent archaeological evidence indicating characteristically modern human types of behaviour and cognition, such as art, ritual and widespread dispersal from Africa (Mithen, 1996).

These timings present a serious challenge to certain popular forms of 'evolutionary psychology', which conceive of the human mind as a set of task-specific modules, or mental organs (e.g., Cosmides & Tooby, 1994; Pinker, 1997). The range of modules is potentially vast; theorists have suggested modules for language, number, facial processing, theory of mind, navigation, object location, and so on (Geary, 1998). As one recent presentation put it:

> Their (modules) operation was shaped by natural selection to solve the problems of the hunting and gathering life led by our ancestors in most of our evolutionary history. (Pinker, 1997, p. 21)

This is an appealing approach, and has inspired numerous publications discussing the modular mind and its implications (e.g., Bjorklund & Pelligrini, 2002; Geary, 1995; Barkow *et al.*, 1992; Butterworth, 1999; Gardner, 1983). Nevertheless, before we get carried away, we should be wary of claiming too much for evolutionary psychology. Consider the language module, which is frequently presented as the paradigm case of an evolved mechanism (Pinker, 1994). There is no evidence among anatomical remains until between 600,000 and 200,000 for a degree of linguistic capacity (Schepartz, 1993). The notion that something as complex as a language module could have become part of universal genetic inheritance in such a short time seems to contradict basic evolutionary theory (Tomasello, 1999).

There is an old New Yorker cartoon, in which two academics are looking at a chalkboard on which is written a complex mathematical equation: the equation begins on the left of the board, with a string of numbers and symbols; these lead to the centre, where there are the words 'then a miracle occurs'; and this leads to the right of the board, where the solution can be found. On the whole, miracle-based explanations for events should generally be avoided. Instead, we should seek explanations of a more mundane, probable character. So, another explanation of human cognitive evolution is needed, and one that is not dependent upon complex and rapid cognitive architectural change. Providing a possible explanation of this sort is the aim of this paper.

Seeing the World Through Another's Eyes

There seems to be only one biological mechanism capable of bringing about such dramatic changes to behaviour and cognition in so short a period of time, and that is *cumulative cultural evolution* (Tomasello, 1999; Carrithers, 1992).

Cultural transmission is fairly common in nature, if culture is defined in the broadest and least anthropocentric way, as 'differences among individuals that exist because they have acquired different behaviours as a result of some form of social learning' (Boyd & Richerson, 1996, p. 79). Of course, the definition of 'culture' continues to be a topic of heated debate in anthropology and the social sciences (see Shore, 1996; Sperber, 1996; Kuper, 1999). Definitions of culture reflect wider views about what it is to be human, so it is not surprising that many writers have ruled out all species apart from our own. Thus, Lankshear (1997, p. 13) distinguishes between the world of culture and the world of nature, and adopts a definition of culture as 'all human activity that is not the pure expression of biological characteristics of the species *Homo*'. Likewise, Shor (1993, p. 30) describes culture as 'the actions and results of humans in society . . .'. However, there is a case to be made that evolutionary and primatological approaches to the study of culture might prove to simplify definitional problems, if only because non-human societies are not expected to exhibit such contentious entities as values, attitudes and beliefs (Boesch & Tomasello, 1998).

Cultural transmission, in the sense implied by Boyd and Richerson's (1996) definition (above), enables animals to exploit the existing knowledge and skills of a group through, for example, following a mother to food, copying species-typical calls, or acquiring the linguistic conventions of peers and adults. In facilitating the acquisition of such knowledge, cultural transmission enables individuals to save considerable time, energy and risk, and greatly enhance survival chances (Heyes & Galef, 1996).

Whilst these different processes might all represent cultural transmission, such transmission is not homogeneous. Numerous distinct processes, social conditions and lines of dissemination through which individuals acquire particular practices within groups have been observed in nature (Boesch & Tomasello, 1998). A hypothesis that might explain humans' distinctive set of behaviours and cognitive skills is, therefore, that they have access to some species-typical forms of cultural transmission, and that these forms go some way to explain the peculiar trajectory of human evolution.

The evidence that humans do have distinctive forms of cultural transmission is overwhelming (Tomasello, 1999). Unlike almost all other animals, moreover, the modifications to cultural practices accumulate from generation to generation with remarkable accuracy. Many animals perform innovative and intelligent behaviours, but these are generally lost when peers or offspring fail to learn them properly (Hauser, 2000). Humans, however, are able to reproduce and modify socially learned skills to great effect, and these skills are able to be passed from generation to generation, during which time improvements might be made, which, in turn, are socially learned and disseminated.

The distinctively human forms of cultural transmission seem to depend upon two processes: accurate transmission and innovation (Tomasello, 1999; Bailey, 2000). The former ensures that there is relative fidelity, as the skill or practice is disseminated from generation to generation. The latter builds upon the foundation provided by accurate transmission, but developing modifications to it. Both of these processes are necessary to account for the speed and power of human change. With accurate transmission but no innovation, cultural evolution would only occur through chance. With innovation but no accurate transmission, newly discovered practices would die with their discoverer (which is what seems to happen with most non-human primates; see Kummer & Goodall, 1985). Together, these processes create an 'evolutionary ratchet' (Carrithers, 1992; Tomasello, 1999), which is necessary for the rapid and progressive changes associated with human cultural change.

Psychologists often distinguish between individual and social learning (Bandura, 1986; Hauser, 2000; Heyes & Galef, 1996). The latter is distinguishable from the former when an animal is exposed to some learning situation to which it would not otherwise be exposed, because it was in some social setting.

Common forms of individual learning are deduction and trial and error. Hauser (2000) reports an observation of Japanese macaques dropping piles of wheat and sand into the ocean, and then skimming the wheat off the surface once the sand has settled to the bottom. This practice has spread, socially, through the population of monkeys living on a particular Japanese island, but it was initially invented by a highly intelligent female. How did she discover the wheat-washing technique? Well, perhaps she wandered over to the edge of the ocean one day, and saw some wheat floating on the surface of the water. She skimmed it off to eat it. Then she is struck by the realisation that, since wheat floats and sand sinks, she might be able to drop the mixed wheat and sand in the water and simply skim off the wheat. This would be an example of deduction. Or, perhaps the monkey tried to separate wheat from sand by throwing the mixture on the floor, and by accident an amount ended up in the nearby water, and she observed the wheat rising to the surface. This would be a form of trial and error learning. What these types of learning have in common is that they are *asocial*, they do not require the presence of others to operate.

In much observed *social* learning, the presence of others plays a relatively minor role: new learning experiences are made available to young animals simply as a consequence of being around others. In other cases, the actions of others play a more active role. For example, an adult chimpanzee's nut-cracking may draw a young observer's attention to the rock and open nut, left on the hard surface necessary for successful cracking, as a result of which, the young chimp picks up the rock and has a go at emulating the effect (Boesch, 1991).

Learning situations of this sort are clearly instrumental in helping learners to make discoveries that they would not make on their own. Social learning, therefore, plays a valuable role in facilitating development, in humans as in other social animals. Social learning, in the sense described, however, fails to account for the peculiarly powerful cultural transmission that is evident in human beings. Whilst social learning can lead to intelligent behaviour in many species, these species seem unable to pass on this new behaviour faithfully to others in the group. Following the 'ratchet' imagery, innovation without accurate transmission leads to 'slippage'.

Humans seem to engage in a specific form of social learning that allows more effective transmission of cultural resources. Accordingly, Tomasello, Kruger and Ratner (1993, p. 496) distinguish 'cultural learning' from other forms of social learning:

> In cultural learning, learners do not just direct their attitudes to the location of another individual's activity; rather, they actually attempt to see the situation the way the other sees it—from inside the other's perspective, as it were.

This development allows humans to learn in qualitatively different ways to other social animals: the learner is able to learn not just *from* another's actions, but also *through* another's actions (ibid.).

Cultural learning is made possible because humans, from an early age, are able to understand others as living mental and intentional lives, like their own. This ability, described variously as 'mind-reading', 'acquiring a theory of mind' or 'adopting the intentional stance' (Bailey, 2002), enables learners to see the world through another's eyes, and to go beyond the immediately observed action, towards an understanding of the reasons for choosing that action rather than another. In terms of human development, this form of learning applies as much to linguistic and social abilities as to technical skills. Indeed, one of the most thoroughly explored uses of such mind-reading skills is in conversation. Grice (1969), for example, pointed out that, in mature symbolic communication, Utterer not only intends Audience to respond in a particular way, but also intends that Audience *recognises* that Utterer intends Audience in that way. Likewise, to learn the conventional use of a tool or a symbol, learners must come to understand its intentional significance: What it is for? What do 'we' do with it? (Tomasello, 1999). This is a skill that comes effortlessly and quickly to most people (Bailey, 2002), so it is rather difficult to appreciate fully the great advantage it offers over other species in acquiring skills and cultural practices.

In many respects, psychological research in this area parallels a traditional philosophical concern, called the 'problem of other minds', reflected in the work of Wittgenstein (1958, 1978), Strawson (1962), Hamlyn (1974, 1978) and Dennett (1996). In part, these philosophers have sought to other a coherent response to the solipsistic challenge that 'my mental states are the only mental states'. For the solipsist, the notion that there could be other people with thoughts, experiences and emotions would have no meaning.

To convey the spirit of this line of argument, and to draw it back to the central issue of this paper, consider the situation of someone who really could not recognise mental states in other. This is no mere thought experiment, as there does seem to be an identified population with difficulties in this area: autistic people. A number of theorists have suggested that it is an inability to infer the mental states in others that causes autistic people to have such great difficulty understanding social environments (Baron-Cohen, 1995; Carruthers, 1996; Leslie, 1991; Hobson, 1993). Sacks (1994, p. 106), describes the difficulties facing one autistic woman whilst at school:

> Something was going on between the other kids, something swift, subtle, constantly changing—an exchange of meanings, a negotiation, a swiftness of understanding so remarkable that sometimes she wondered if they were all telepathic. She is now aware of the existence of these social signals. She can infer them, she says, but she herself cannot perceive them, cannot participate in this magical communication directly, or conceive of the many-levelled, kaleidoscopic states of mind behind it.

Cohen's (1980, p. 383) autistic patient is even more explicit:

> I really didn't know there were other people until I was seven years old . . . I never could have a friend. I really didn't know what to do with other people, really.

Autistic people are severely restricted in the extent to which they can communicate, share and connect with other people, and, thus, benefit from the process of cultural learning. They seem to stand outside of the social milieu and observe, and such non-participatory observation is inadequate to provide an understanding of other people and other minds

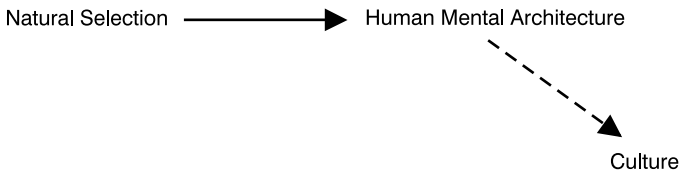

Figure 2. **Culture as an expression of information-processing modules**

(Hobson, 1993). As Hamlyn (1974) puts it, we cannot have a proper conception of a possible object of knowledge unless we understand what relationships exist between the object and ourselves. In order to understand what people are, we need to experience the sorts of intersubjective relationships between ourselves and other minds.

The Intersubjective Species Par Excellence

The argument of this paper locates an evolutionary model of human development much more firmly within the socio-cultural tradition than alternative schemes. In fact, many evolutionary theorists seem determined to marginalise the significance of culture, in their pursuit of 'essential human nature'. They assume a linear causal relationship from evolution of information-processing mechanisms (such as evolutionary psychology's modules) to the generation of culture:

> Culture is not causeless and disembodied. It is generated in rich and intricate ways by information-processing mechanisms situated in human minds. These mechanisms are, in turn, the elaborately sculptured product of the evolutionary process. Therefore, to understand the relationship between biology and culture one must first understand the architecture of our evolved psychology. (Cosmides *et al.*, 1992, p. 3)

The assumption seems to be that the truly emergent feature of human evolution was the distinctive human mental capacity, with its suite of specialist information-processing modules. Culture, according to this model, is an *expression* of this mental capacity (see Figure 2).

But culture is not an addendum to the human mind, as Vygotsky (1978), Bruner (1996) and Cole (1996) have shown very clearly. Humans are not born biologically or psychologically *prior* to their differentiation by culture. They cannot, and do not, exist outside of culture, no matter how young they may be.

Trevarthen (1998) has argued that children have an innate need to live and learn in culture, and that their motivation to do so is one that strives to understand the world by sharing experiences and purposes with other minds. The ability to understand other minds is often called 'intersubjectivity.' 'We are the intersubjective species par excellence' (Bruner, 1996, p. 20). From a very early age, children are tuned to others' actions and emotions. So, from soon after birth human infants engage in 'protoconversations' (Trevarthen, 1979), or social interactions in which parent and child focus their attention on each other in ways that serve to share emotion. Also, from a few weeks old, infants mimic bodily movements of adults (Meltzoff, 1996).

Cultural learning primarily occurs through interacting with other people. Tomasello, Kruger and Ratner (1993) propose three basic forms of cultural learning: imitative learning, instructed learning and collaborative learning. These types of learning are made possible by distinctively human intersubjectivity.

Imitative learning occurs when the learner internalises something of the demonstrator's behaviour (ibid.). Meltzoff (1996) has suggested three features of imitation in human infants. First, infants are 'imitative generalists': they imitate a range of novel and arbitrary acts. Second, imitation is intrinsically motivating for the young. Finally, imitation is often bi-directional: parent and infants frequently reciprocally match each other's behaviours. It is important to appreciate that human imitation is not the same as 'mimicking', since it involves the taking of another person's perspective in order to reproduce both mean *and* ends as one acts. It is also worth noting that imitation is not, as sometimes assumed, a passive form of learning. On the contrary, the learner is actively trying to understand an intention and match a behaviour, and their choice of models can be idiosyncratic and unpredictable (Bailey, 2000).

Comparative studies of imitation on other animals has led to some hotly debated findings. There are numerous recorded examples of animals seeming to 'copy' behaviours, in one way or another (Heyes, 1996). However, these instances have rarely stood up to examination, since simpler explanations in terms of individual learning fit the evidence just as well (Galef, 1988). Moreover, attempts to recreate such behaviour in experimental settings have found little success (Hauser, 2000). It is interesting that the most plausible examples of primate imitation are among chimpanzees brought up among humans (Whiten & Custance, 1996; Tomasello, 1996), and that even these chimps imitate with relatively poor fidelity. Human infants as young as two years of age, on the other hand, regularly imitate with high degrees of accuracy, and also seem capable of distinguishing between the goal of an action and the process for achieving that goal (Hauser, 2000), which suggests an awareness of the intentions of the actor, and not just the actions witnessed.

Instructed learning involves learners learning about an adult's understanding of a task and how that compares with their own (Tomasello, Kruger & Ratner, 1993). This intersubjective quality differentiates instructed learning from other forms of learning that sometimes go under the banner of 'teaching'. There are many ways in which adults can support learning, such as simplifying a task or through giving clues to a problem's solution. Such 'scaffolding' certainly has the potential to improve learning and performance (Wood, Bruner & Ross, 1976). However, these are examples of *social*, rather than genuinely *cultural* learning, since the child need not learn about the adult's intentions or perspective. During instructed learning, the adult regulates the child's performance, usually through talk at critical points, and the learner attempts to understand the task from the adult's point of view. That is to say, the learner attempts 'to enter into an intersubjective understanding of the task' (Tomasello, Kruger & Ratner, 1993, p. 499), or to internalise the adult's instructions in relation to their own task understanding.

There is a range of evidence to suggest that children become capable of engaging in instructed learning from about 4 years of age. By 4 years of age, for example, most children are able to recognise others as mental agents with thoughts and beliefs that may be false or different from their own (Bailey, 2000). At about the same time, infants start to use the language of mental states, use language to regulate their behaviour, and employ meta-cognitive strategies in support of their learning (Tomasello, Kruger & Ratner, 1993).

For instructed learning to take place, though, more is required than simply the learner's ability to read the intentions of the adult. As Olson and Astington (1993) point out, there is a logical asymmetry between the level of social cognition needed by the teacher and the learner. To learn by instructed learning, the learner must be able to recognise the intentionality of the model. However, to provide that model, the teacher must operate at a significantly higher level, as the teacher must have some notion of the learner's knowledge

or ignorance of a specific task. Therefore, the teacher needs to be able to recognise false beliefs in the learner, and also have some acknowledgement of the learner's beliefs about the teacher's intentions, so that the teacher is able to spot misunderstandings on the part of the learner. So, Olson and Astington imply, the real clincher in such learning is not the ability to imitate, but the ability to *teach*, and that ability is, presumably, a product of cultural evolution, itself, since instructed learning takes so many forms in different communities (Rogoff, 1990; Lave & Wenger, 1991; Whiting & Edwards, 1988; LeVine *et al.*, 1994; Keefer & Brazelton, 1994).

If instructed learning occurs outside of the human species, it is very rare indeed. There are a number of reported instances in which an adult supports the learning of a young animal in some seemingly deliberate way (Caro & Hauser, 1992; King, 1991), but these do not fulfil the criteria of instructed learning outlined above. As far as I am aware, there are only two examples in the literature of behaviour by non-human animals that approximates instructed learning, and they both were exhibited by chimpanzees, and reported by Boesch (1991). One occasion involved a mother slowing down and modifying her nut cracking, and the other involved a mother modifying the positioning of a nut. In both cases, the adults appeared to adjust her behaviour in response to difficulties encountered by the learner. These observation *may* indicate that chimpanzees have the *potential* to recognise inappropriate behaviour in a learner and adapt their actions in a way likely to support improvement. However, there is no evidence that the actions of the two mothers in these examples had any effect upon the learner's performance (Hauser, 2000). Moreover, it may be the case that the two instances of reported 'instruction' were nothing of the kind, and were merely instances of adults temporary and arbitrarily changing their normal action, whilst, by coincidence, being in the presence of infants. Either way, their very rarity (two observations in 150 years of chimpanzee observations) underlines the distinctiveness of such learning in humans.

The final form of cultural learning, collaborative learning, takes place when neither participant is an authority. Typically, two children work together on a problem and arrive together at the same solution (Phelps & Damon, 1989). They then individually internalise their co-constructed knowledge (Wells, 1999). Whilst there are many instances in which pre-school children work together, it is not clear that they are engaged in collaboratively constructing knowledge at this stage. Rather, they seem to be working in parallel on a task (Azmitia, 1988). Indirect evidence suggests that the ability to problem-solve collaboratively emerges at about 6 years of age. Collaborative learning involves an understanding of second-order mental states ('I think that he thinks that we should do this'), whilst imitation and instructed learning can operate with only an understanding of first-order states ('he thinks that we should do this'). Most children are able to understand second-order mental states at about 6 years of age (Bailey, 2000a). At about the same time, children are capable of reflective and recursive dialogues (Kruger & Tomasello, 1996), which also seem likely to underpin collaborative learning.

Can non-human animals engage in collaborative learning? It seems not. There have been many observations of animals appearing to *co-operate*, especially during hunting (Boesch, 1993; Hauser, 2000), but there are no reports of non-human animals collaboratively solving a shared problem (Tomasello, Kruger & Ratner, 1993). This is almost certainly due to the complexity of the social cognition required to achieve this type of learning, and it is for a similar reason that collaborative learning appears in human infants after the other forms of cultural learning.

By way of summary, the three types of cultural learning are presented below (Table 1).

Table 1 **Main features of the three types of cultural learning (adapted from Tomasello*et al.*, 1993)**

Type of cultural learning	Age of first appearance	Social-cognitive ability	Concept of person
Imitative learning	9 months	Perspective-taking (e.g., joint attention)	Intentional agent
Instructed learning	4 years	Intersubjectivity (e.g., false belief)	Mental agent
Collaborative learning	6 years	Recursive intersubjectivity (e.g., recursive mental state language)	Reflective agent

Education as a Human Science–Concluding Comments

In *The Selfish Gene*, Richard Dawkins made the following accusation:

> The full implications of Darwin's revolution have yet to be widely realised . . . even those who choose to study it often make their decision without appreciating its profound philosophical significance. Philosophy and the subjects known as 'humanities' are still almost as if Darwin had never lived. (1976, p. ix)

I suspect that this is still broadly the case, although there have been some notable attempts to inform disciplines with a recognition that we are, in fact, an evolved species. So, for example, we find Darwinian approaches to philosophy (Rosenberg, 2000), linguistics (Pinker, 1994), archaeology (Mithen, 1996) and history (Bloom, 1995). A Darwinian literary criticism has even appeared (Symon & Salmon, 2001)! Acceptance by educationalists, however, has been less enthusiastic (see Bernhard, 1988, and Geary, 1995, for initial forays). Perhaps they share a concern stated by Bruner (1996, p. 164): 'Culture imposes revolutionary *discontinuity* between man and the rest of the animal kingdom. And it is this discontinuity that creates the difficulty in extrapolating directly from evolutionary biology to the human condition'.

A central theme of this paper has been that it is possible to offer a Darwin-inspired view of learning that does not follow the ultra-reductionist pathways of some evolutionary thinkers. But, more importantly, it has also asserted that without an evolutionary foundation, explanations of learning will inevitably be incomplete. This is because education and its parent disciplines are 'human sciences', and the subject matter of human sciences are *homo sapiens* (Mazlish, 1998). The nature of this species ought to be of enormous relevance, indeed urgency, to those of us working in the human sciences.

This paper has argued for the central importance of intersubjectivity in human learning. At the least, this theory puts yet another nail in the coffin of the transmissionist theories of learning (Pinker, 2002). But it also undermines more progressive models which conceive of learning as an essentially individualised activity (Bailey, 2000). It may be that there are many learning activities that require little or no intersubjective engagement, such as the memorisation of multiplication tables (Phelps & Damon, 1989), but there are many more tasks that are premised upon the sorts of 'mind-reading' skills described in this paper. As a species-specific suite of skills, cultural learning, through imitation, instruction and collaboration, forms a necessary feature of the process by which children learn to be human.

Moreover, an assumption that lies implicit throughout this paper is that we cannot understand human culture without understanding distinctively human processes of learning. Education is a significant embodiment of community's way of life, and not just a preparation for it. Thus, there is value in at least exploring such educational issues from an evolutionary perspective. Children's cultural learning seems to be a fruitful place to start.

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