The Descent of Mind

Psychological Perspectives on Hominid Evolution

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The evolution of a theory of mind

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Introduction

Homo sapiens is arguably the only species that possesses a developed 'theory of mind.' By this I mean the ability to attribute the full range of mental states (both goal states and epistemic states) to ourselves and to others, and to use such attributions to make sense of and predict behaviour. 'Theory of mind' is the phrase coined by Premack and Woodruff (1978), and there is a set of synonyms for this ability: mind-reading (Whiten 1991), mentalizing (Morton *et al.* 1991), folk psychology (Wellman 1990), and the intentional stance (Dennett 1987). In this chapter, I will use the term theory of mind, for convenience, whilst assuming that any of these alternative synonyms would be equally applicable.

There is considerable interest in tracing the evolution of a theory of mind, because of its central importance in modern human behaviour. Like language or bipedalism, a theory of mind can be taken as a major milestone in primate evolution. The importance of language and bipedalism is in some sense easier to see, or at least, the arguments are more familiar. Among other things, language enabled primates to manipulate the behaviour of conspecifics at a distance (a form of remote control), to obtain information about events that they had not directly witnessed, to inform others about events they had not directly witnessed, and to act cooperatively. Bipedalism enabled primates to use their forelimbs for activities other than just locomotion, such as carrying, throwing, and transforming objects. It also enabled foraging into new niches by reducing water loss. For at least these reasons, language and bipedalism have been justifiably the subject of considerable research. But why might a theory of mind be important? In what way might it have transformed primate evolution? Is it really justifiable to equate the importance of a theory of mind with that of language or bipedalism?

In this chapter I try to do two things. First, I want to persuade you that actually the evolution of a theory of mind is not only *as* important as these other developments, but it is in some respects *more* important. The main argument I will use here is that without a theory of mind, having the ability to speak or perceive speech would have been of little value. You can guess therefore that I will be arguing that a theory of mind must have *preceded* any ability to use language in the communicative way in which it is used today. Secondly, I want to question the claim by Mithen (1996) that a theory of mind evolved around six million years ago. This claim is made on the basis

out to change the beliefs of the doe. Equally, a male gorilla beating his chest might have the effect of making another male gorilla turn and run away, but this again does not count as an act of intentional persuasion. It might be no more complex than the earlier example of the dog barking, causing the cat to run away. There is no evidence that the animal is considering the mental states of the audience.

Intentionally deceiving others

Intentional deception also requires a theory of mind. Indeed, we will define intentional deception as occurring when one animal attempts to place false information in the mind of another, or attempts to withhold true information from the mind of another. Thus, making a trail of footprints lead from locations A to B, and then swinging through the trees (thereby leaving no footprints) to hide in location C, would count as an instance of intentional deception. Rubbing out the trail of footprints from A to B would also count as intentional deception. In both cases, the first animal is attempting to influence the knowledge state of another animal.

In contrast, a stick insect, whose appearance saves it from being eaten by a predator, is not engaging in a deception that requires any theory of mind. Indeed, the stick insect might not be thinking about anything, let alone the mind of its predator. The same applies to an animal with camouflage. It is true that, by staying still, it might not be seen by its predator, but it was probably not aiming to make other animals *think* it was not there. It was not necessarily thinking about what other animals were thinking at all.

Building shared plans and goals

Sharing a plan or goal with another animal requires a 'meeting of minds.' Both animals must recognize the intention of the other animal, and subsequently work out how to mesh their actions with those of the other animal to achieve the shared goal. Take this example. A troop of chimpanzees are hunting a baby monkey, to eat it. The goal is to get the infant monkey away from its mother, scare off the adult monkeys, and kill the baby. They hunt as a team, and achieve the goal. This might not be evidence of building a shared plan in that each individual chimpanzee might simply be pursuing their own individual goals, which just happen to coincide. Thus, an infant monkey comes into sight, and adult male chimpanzees love the taste of baby monkeys, so all the adult male chimps in the troop recognize the reward and aim for it. The adult male chimps' goals all coincide because they all share the same taste or food preference. They mesh their actions with those of the other chimps, in the sense that as one chimp attempts to grab the infant monkey and gets beaten off, the next one jumps in and tries to do the same thing. Each chimp might even recognize the intentions of the others, representing for example that 'He is trying to get the infant monkey.' But this still falls short of being an example of building shared plans, in that a shared plan involves both animals recognizing that they are both holding the same goal.

In contrast, consider another example. Two chimps carry a log, then lean it up against a high wall. One holds it still whilst the other scrambles up it. When the

climber reaches the top, he then turns and holds the log whilst the other chimp scrambles up it. This counts as a convincing example of building a shared plan in that the goal is not achievable without the help of the other animal, and both animals cannot help each other without realizing what both are aiming at. With this joint plan in mind, each can recognize why the other is taking the different role that they are (e.g. the holder of the log versus the climber up the log).

Intentionally sharing a focus or topic of attention

The same argument applies to the sharing of a focus of attention. Two animals can coincidentally look at the same target. This is not shared attention, if each animal is simply aware only of his or her own viewpoint. Shared attention is necessarily mentalistic in that both animals must be aware of the other animal being aware of looking at the same target as they are. Thus, I see you turn to look out of the window. If I then look out of the window, this is not necessarily shared attention. If I see you have looked back and have seen me looking out of the window, then this probably is. More convincing is when you point out the window, and keep pointing until I turn to look out the window. The chances are that if this is genuine shared attention, then I will acknowledge in some way that I have seen what you were trying to get me to see. I will turn back to look at you, and smile, or nod, etc.

Pretending

Last on this list is pretending. This is different from intentional deception in that the intention is not to mislead or plant a false belief in an audience, but simply to pretend. The intention is to temporarily treat one object as if it is another, or as if it had attributes that it clearly does not have. Pretending necessarily requires a theory of mind in that one has to be able to switch between thinking about one's *knowledge* of the real identity of the object, and its current *pretend* identity. Pretending only exists in the mind of the pretender. It is not an intrinsic part of the object.

The empirical contribution of studying autism

Let us take stock. We have surveyed eight behaviours which all usually require a theory of mind. The reason for this brief survey was to illustrate how important a theory of mind is. Without a theory of mind, none of these behaviours would be seen. This is true by definition, if the analysis of the above eight behaviours is correct. But it is also true empirically: Children with autism are a natural test of this in that many of these children fail the standard test of understanding false beliefs, suggesting they have difficulties in the development of a theory of mind, and they fail to show the above behaviours in the normal way (see Baron-Cohen 1995 for a review of the evidence, which is:

1) First-order mind-reading tests:
   (a) The *mental–physical* distinction (Wellman and Estes 1986; Baron-Cohen 1989a)

(b) The *functions of the mind* test (Wellman and Estes 1986; Baron-Cohen 1989a).
(c) The *appearance–reality distinction* (Flavell *et al.* 1986; Wellman and Estes 1986; Baron-Cohen 1989a).
(d) *First-order false belief* tasks (Wimmer and Perner 1983; Baron-Cohen *et al.* 1985, 1986; Perner *et al.* 1989; Reed and Peterson 1990; Leekam and Perner 1991; Swettenham *et al.* 1996).
(e) The *seeing leads to knowing* test (Leslie and Frith 1988; Pratt and Bryant 1990; Baron-Cohen and Goodhart 1994).
(f) *Recognizing mental state words* test (Baron-Cohen *et al.* 1994).
(g) Simple *causes of emotion* (such as situations and desire) versus complex causes of emotion (such as beliefs) (Harris *et al.* 1989; Baron-Cohen 1991; Baron-Cohen *et al.* 1993).
(h) *Recognizing the eye-region of the face* as indicating when a person is thinking and what a person might *want* (Baron-Cohen and Cross 1992; Baron-Cohen *et al.* 1995; Baron-Cohen, 1989b).
(i) The *accidental–intentional* distinction (Phillips 1993).
(j) *Deception*, premised on the understanding that people's beliefs can differ and can therefore be manipulated (Baron-Cohen 1992; Sodian and Frith 1992; Yirmiya *et al.* 1996).
(k) Tests of understanding *metaphor, sarcasm, and irony*—these all being *intentional, non-literal* statements (Happe 1993).
(l) *Pragmatics* (Baron-Cohen 1988b; see also Tager-Flusberg 1993), e.g. recognizing violations of pragmatic rules, such as the Gricean maxims of conversational cooperation (Surian *et al.* 1996). Since many pragmatic rules involve tailoring one's speech to what the listener needs to *know*, or might be *interested* in, this can be seen as intrinsically linked to a theory of mind.

2) Second-order mind-reading tests:
(a) Second-order *false-belief* tests (Perner and Wimmer 1985; Baron-Cohen 1988b), that is, tests of understanding what one character thinks another character thinks. Such second-order reasoning is usually understood by children of 5–6 years of age (Sullivan *et al.* 1994).
(b) *Bluff and double-bluff* (Happe 1994).
(c) Decoding *complex mental states from the expression in the eye-region of the face* (Baron-Cohen *et al.* 1997*a*, *b*).

ıdeed, autism is a clear illustration of what human life would be like if one lacked a ieory of mind. The most devastating effect is on the ability to socialize, communiıte, and use imagination. It is hard to think of aspects of our psychology that are ore central or important than these. Certainly, I hope you agree, they are at least as ıportant as language (syntax), or bipedalism.

ınguage without a theory of mind

ıildren with autism also show us how useless a language capacity is without a theory mind. Strip out a theory of mind from language use and you have an individual who

might have some syntax, the ability to build a vocabulary, and a semantic system.[2] Crucially, what would be missing from their language use and comprehension is 'pragmatics'—being able to decipher the speaker's communicative intentions, decipher non-literal language, read 'between the lines,' understand jokes, and tailor one's speech to fit the listener's background mental states (their knowledge, interest, expectations, etc.). This is the aspect of language that is missing from the language of most children with autism (Paul and Cohen 1985; Baron-Cohen 1988*a*, *b*; Tager-Flusberg 1992, 1993; Surian *et al.* 1996). The relationship between language and theory of mind is likely to be a very complex one, for several reasons. First, understanding that words refer presumes a concept of intention or goal. Second, mapping reference correctly, in language acquisition, is massively facilitated by joint attention (Baldwin 1991), itself an early form of mind-reading (Baron-Cohen 1995). These two points imply that normal 12- to 18-month-old language learners benefit from first having the mental-state concepts of intention and attention. Without these, the infant would be left with the puzzle of what people are doing while they are talking. Third, language serves as a virtual 'print-out' of a speaker's mind for the listener, giving the listener access to a description of the speaker's thoughts. Fourth, syntax can serve to disambiguate a speaker's intended meaning; that is, syntax can be used for the informing function (Cheney, personal communication). For example, shouting 'Leopard!' is quite ambiguous. Shouting 'Leopard in the tree above your head!' is not. Given this set of connections between language and theory of mind, it might be no surprise that children with autism, who are impaired in theory of mind, invariably show language delay.

When did a theory of mind evolve?

Let us turn to the question of most relevance to this book: the question of evolution. Here, things are necessarily speculative, as we attempt to peer into the mists of time, but there are two strategies available to us to answer this question. First, we can ask whether existing monkey and ape species have a full theory of mind. If so, we can assume that a theory of mind evolved as early as the common ancestor between us and the existing primate species. Second, we can ask what clues the palaeo-archaeological record gives us about the early hominids, and try to infer their behaviour and hence their cognitive abilities from fossil records, and from their tool use, cave paintings, ornamentation, etc.

The six-million-years hypothesis

The first strategy, that of looking at extant species of monkeys and apes, has led field observers to conclude that monkeys show little if any evidence of a theory of mind, but that modern apes do. That is, they show signs of deception in their natural behaviour, and this is one hallmark of a theory of mind (Byrne and Whiten 1991;

[2] Language without a theory of mind is not of course entirely useless. It allows literal communication, acquisition of information from others, requesting, ordering, etc.

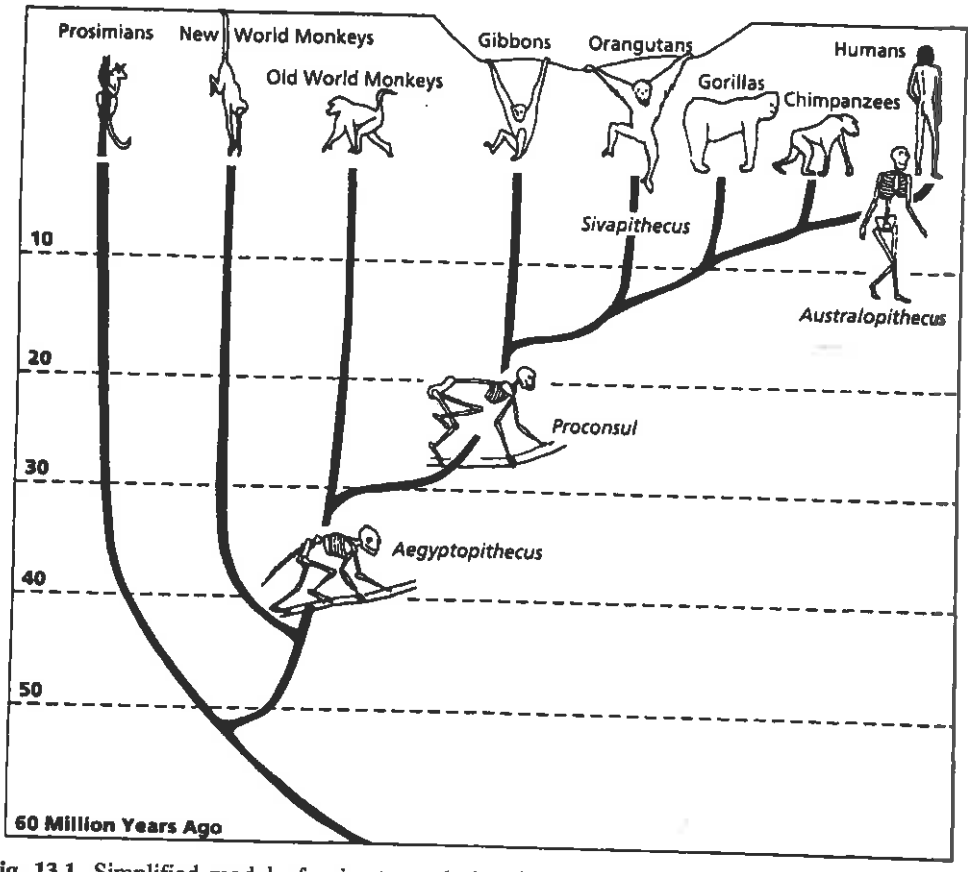

Fig. 13.1. Simplified model of primate evolution (reproduced from Mithen (1997) with kind permission).

Byrne this volume). This leads Byrne and Whiten to conclude that the common ancestor of modern humans and apes, had at least elements of a theory of mind. This is not so very old in evolutionary terms—for example, the common ancestor of modern humans and monkeys lived around 35 million years ago (see Fig. 13.1)—but it is still very old compared with the alternative hypothesis, reviewed next.

There is reason to doubt the six-million-years hypothesis. Experimental tests of a theory of mind in modern apes have found it hard to obtain convincing evidence of the ability to attribute beliefs to others. Even Premack, who was one of the first to ask the question of whether chimpanzees could attribute false beliefs (Premack and Woodruff 1978), finally concluded that they could not when their chimpanzees failed a better test of that ability (Premack 1988). In fact Povinelli and Eddy (1996) have found it hard to obtain evidence that chimpanzees even understand gaze as an indicator of the mental state of attention, in the way human children do.

There is a second reason to doubt the six-million-years hypothesis. If modern apes (chimpanzees, orang-utans, and gorillas) have a theory of mind, why don't we see signs of the eight behaviours listed above in their natural behaviour? Cheney and Seyfarth

(1990) put forward some interesting data suggesting that monkeys might have 'words,' but they conclude that monkeys only use these 'words' to change the behaviour of the listener, and not the listener's mental state. Equally, to take the last item on the earlier list, why don't we see evidence of pretend play in monkeys or apes—a behaviour which in human children emerges very early, around 18 months of age (Leslie 1987)?

Palaeo-archaeological evidence: The 40 000 years hypothesis

We can then turn to the alternative strategy for dating the evolution of a theory of mind, namely, that of addressing the palaeo-archaeological record. This tells us that *tool use* was evident from some two to three million years ago (see Corballis, this volume), and became more sophisticated over time. By itself, this is not sufficient evidence that these hominid ancestors had a theory of mind.

Around 30 000 years ago one sees the earliest examples of *cave paintings*, but again this is not evidence that the artists had a theory of mind. Some people might be drawn to conclude that any animal capable of art must have a theory of mind, but many children with autism, who fail tests of a theory of mind, and who show none of the eight behaviours listed earlier, are able and even gifted artists (Selfe 1977; Charman and Baron-Cohen 1992, 1993). Art clearly requires an ability to represent representations, but not necessarily an ability to represent mental states like beliefs. (For more on this distinction, see Leekam and Perner 1991; Leslie and Thaiss 1992; Charman and Baron-Cohen 1995).

The first fiction

Mithen (1996) has performed an invaluable service to cognitive neuroscience in reviewing some much more relevant evidence from palaeo-archaeology. Around the same time, 30 000 years ago, we see the first evidence of special forms of art: statues of *impossible entities*, such as the half-man-half lion ivory statuette from Hohlenstein-Stadel, southern Germany, dated around 30–33 000 years ago (see Fig. 13.2), and the painting of the half-man-half-reindeer, from Trois-Freres, Ariege, in France (see Fig. 13.3).

These are of interest because they are representations of *fictions*. They are necessarily representations of the artist's mind, of the artist thinking about his or her own thoughts. They are also, incidentally, direct evidence of the capacity for pretend play. Animals that are half-man-half-lion have never existed, except in the world of the imagination, of pretence (I am happy to be corrected on this point). So, we can say with some confidence that a full theory of mind must be at least as old as 30- to 40 000 years.[3]

Supporting evidence: adornment

There is further evidence that *H. sapiens* had a theory of mind by then. The

[3] Peter Carruthers (pers. comm.) argues that pretence and fiction may not necessarily require a theory of mind—merely the capacity to reason suppositionally. This is logically correct, but psychologically pretence

Fig. 13.2. Statuette from Hohlenstein-Stadel, 30–33 000 years old (reproduced from Mithen (1996) with kind permission).

archaeological record shows the existence of burial at this time, which implies that our ancestors then were concerned about death. By itself, this does not tell us that they could think about the mind. But Mithen points out that burials around 28 000 years ago also include the dead person being *adorned with jewellery*. For example, at Sungir, in Russia, a 60-year-old man was buried with an adolescent male and female. All three individuals were decorated with thousands of ivory beads, necklaces, and bracelets (see Fig. 13.4).

Now why would someone adorn themselves, or adorn their dead relative? This behaviour can be taken as evidence that the decorator cared about how other people perceived the adorned person—they wanted an audience to *think* the person was beautiful, or of high status, or worthy of an after-life, or whatever. If this is not an excessively rich interpretation of jewellery-use, then it is an additional strand of evidence that around 30- to 40 000 years ago, our ancestors had a theory of mind.

Is early religion relevant?

If the archaeological evidence from these burials also indicates the existence of

Fig. 13.3. Painting from **Trois-Freres,** 30 000 years old (reproduced from Mithen (1996) with kind permission).

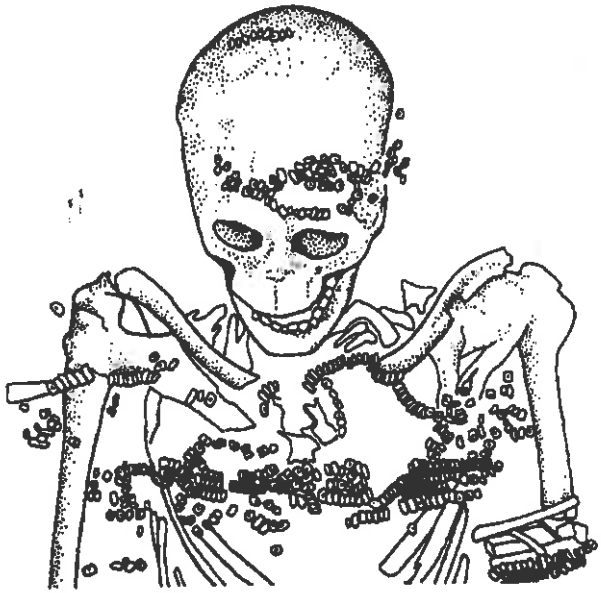

Fig. 13.4. Skeleton from Sringir, 30 000 years old (reproduced from Mithen (1996) with kind permission).

religion, then this might also be supportive evidence of the existence of a theory of mind 40 000 years ago. This is because anthropological evidence (Boyer 1990) suggests that the common feature of all current religions is that a supernatural agency—a god, a spirit—is postulated who can *communicate* with you, possibly judge (i.e. *think about*) you, and who can be appeased by ritual acts. The idea of a supernatural agency of this kind would be impossible without a theory of mind. Indeed, the idea that ritual actions might cause good outcomes or ward off bad ones is itself a belief in intentional causation rather than purely physical causation.

But let us leave religion out of it, since adorned skeletons in graves are not clear evidence of religion. Rather, let us stick to our two strong clues—art of a purely fictional kind (Figs 13.2 and 13.3) and adornment (Fig. 13.4). Here we can jump back to ask about these behaviours in autism, since children with autism who lack a theory of mind should also not produce art of a purely fictional kind, or bother with adornment. What does the evidence show?

Back to autism

Consistent with this idea, children with autism do draw, but tend to draw objects they have seen (buildings, cars, electricity pylons, train-stations, etc.). When challenged to draw purely fictional entities, like a 'man that could never exist,' normal 4-year-old children oblige by producing sketches of men with two heads or three arms or some such (Karmiloff-Smith 1990), whereas children with autism have difficulty doing so (Scott and Baron-Cohen 1996). Those children with autism who are more able, and who can pass first-order theory of mind tests, can draw such fictional entities (Craig *et al.* submitted). This is empirical evidence that the kind of art we think of as involving pretend play is a good indicator of whether the artist has a theory of mind. There is no systematic evidence about adornment in autism, but it is widely noted that children with autism pay little attention to how they appear to others, for example, showing little if any signs of embarrassment (Baron-Cohen *et al.* 1993) or interest in fashion (Baron-Cohen 1993).

Conclusions

Mithen (1996) clearly supports the six-million-years hypothesis:

> A specialized domain of social intelligence first appeared in the course of human evolution after 55 million years ago. This gradually increased in complexity with the addition of further mental modules, such as that for a theory of mind between 35 and six million years ago (p. 94).

He bases this conclusion on the evident 'social intelligence' of monkeys and apes today. However, there is a danger of confounding social intelligence with theory of mind. It is clear that many monkey species and the apes show social intelligence in that they form alliances, keep track of social status, and behave tactically in grooming those allies they depend on (de Waal 1989; Whiten 1991). Whilst this is fascinating, and might be evidence of social intelligence evolving independently of general intelligence, it is not necessarily evidence of the possession of a theory of mind. For

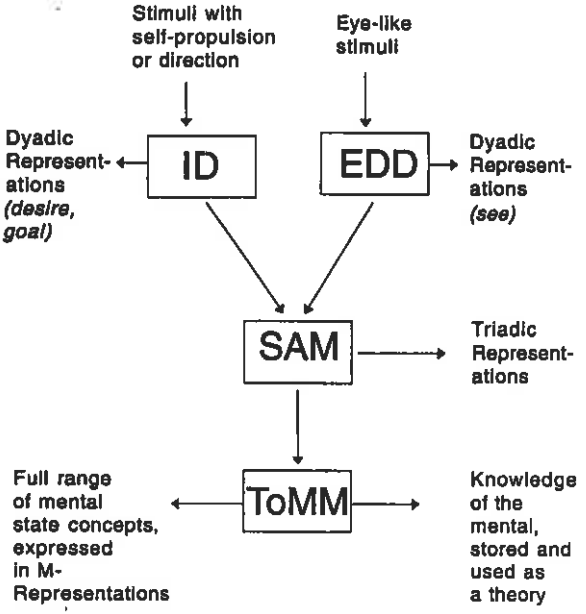

Fig. 13.5. The mind-reading system (*from* Baron-Cohen 1995).

the latter, it would be more convincing if there were signs of one or more of the eight behaviours listed earlier. For that reason, in this chapter I remain more cautious, concluding simply that a theory of mind had in all likelihood evolved by 40 000 years ago, but that before this time there is as yet no clear evidence for it.

Mithen's conclusions are also based on his claim that "both monkeys and apes also engage in intentional communication" (p. 161). Here again one sees a potential confound. Clearly, monkeys and apes vocalize or gesture intentionally, but this is not the same as 'intending to communicate', as defined in the first section above. Monkeys and apes might be vocalizing or gesturing with the intention to alter the behaviour of the listener or audience, but there is no compelling evidence yet that they are vocalizing or gesturing with the intention to alter the mental states of their listener or audience (Cheney and Seyfarth 1990).

Using a model of the mind-reading system shown in Fig. 13.5, there is better evidence for the ability to attribute goal states (involving ID, or the Intentionality Detector) being as old as Mithen suggests, in that chimpanzees can clearly recognize *goal* states (Premack and Woodruff 1978). They are also acutely aware of gaze direction (EDD, or the Eye Direction Detector), suggesting they are monitoring when they might be the target of another's perception (Chance 1967). Less clear cut is whether they show shared attention (SAM, or the Shared Attention Mechanism) (Povinelli and Eddy 1996). This means that elements of mind-reading might be as old as 6–35 million years, and evolution might have 'tinkered with old parts' under selection pressure, to produce a theory of mind mechanism (ToMM) more recently.

Finally, we might consider that the presence of a Broca's area in the brain 200 000 years ago (as inferred from cranial evidence—Mithen 1996, and see Corballis, this

volume) implies a theory of mind might be at least this old, in that language without a theory of mind would be functionally very limited. But this is only indirect evidence for the existence of a theory of mind. A more powerful logical argument is that 'theory of mind' must have been present in *H. sapiens* 100—150 000 years ago, or at least before the dispersion from Africa. Otherwise, one would have to assume parallel evolution of theory of mind (see also Byrne, this volume; Suddendorf, this volume).[4]

A theory of mind is a powerful means of making sense of the social world. It enables explanations and prediction of the behaviour of agents, and communication (beyond animal signalling). Given its centrality to what makes the human mind essentially human, its evolution needs investigation. Palaeo-archaeological evidence shows that it was in place at least 40 000 years ago, and comparative data from studies of existing primates shows that aspects of a theory of mind might be as old as six million years. Specifically, recognizing *volitional* states and a sensitivity to *eye-direction* might be a skill we share with the apes, and therefore with our common ancestor six million years ago. In contrast, *shared attention* and recognizing *epistemic* states might be unique to *H. sapiens* and may therefore have evolved more recently. In terms of the model of the 'mind-reading system' shown in Fig. 13.5, ID and EDD might be phylogenetically older (at least six million years) than the more recent SAM and ToMM. This leads to the idea that a theory of mind did not necessarily evolve all at once, but by degrees.

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[4] To clarify, I am arguing that there is quite persuasive evidence for a full theory of mind 30–40 000 years ago, and some evidence for it as far back as 150 000 years ago. Beyond this, we await better clues.

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