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Human Creativity: Its Cognitive Basis, its Evolution, and its Connections with Childhood Pretence

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ABSTRACT

This paper defends two initial claims. First, it argues that essentially the same cognitive resources are shared by adult creative thinking and problem-solving, on the one hand, and by childhood pretend play, on the other—namely, capacities to generate and to reason with suppositions (or imagined possibilities). Second, it argues that the evolutionary function of childhood pretence is to practice and enhance adult forms of creativity. The paper goes on to show how these proposals can provide a smooth and evolutionarily-plausible explanation of the gap between the first appearance of our species in Southern Africa some 100,000 years ago, and the 'creative explosion' of cultural, technological and artistic change which took place within dispersed human populations some 60,000 years later. The intention of the paper is to sketch a proposal which might serve as a guide for future interdisciplinary research.

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1 Introduction

Human beings are unique in lots of ways, and human beings are especially smart in lots of ways. We are capable of acquiring and retaining immense

amounts of information over our individual life-times; we are capable of learning and fine-tuning a great many skills and new activities; and we are capable of using and interpreting speech. But one of the most striking species-specific features of *Homo sapiens sapiens*, surely, is the degree of *creativity* and *innovation* which we display in our thought and behavior, both within the lives of individuals and across different human cultures. This manifests itself in story-telling, in art, in the construction of bodily ornaments and decorations, in humor, in religion-building, in theory-construction, in problem-solving, in technological innovation, and in myriad other ways.

Creativity, as I shall understand it, will normally manifest itself in new types of behavior, going beyond mere re-applications of established scripts or action-patterns. And creativity itself is constituted, in part, by a capacity to combine ideas together in novel ways in abstraction from any immediate environmental stimulation (see Section 2 below for further discussion). So a creature adopting a novel solution to an environmental problem may be acting creatively, whereas one which is merely applying an old solution in new circumstances (e.g. dipping for ants with one sort of stick rather than another) will not be. And anyone who is imagining how things could be other than they are will be thinking creatively, whereas someone who thinks, 'The cat is vomiting purple liquid', in the presence of a cat doing just that, will not be, even if they have never before entertained a thought with that content. When applied as a predicate of individuals, 'creative' will be a matter of degree, of course—a person or creature can be more or less creative by engaging to a greater or lesser extent in creative behaviors and creative thought-processes.

What makes the distinctively-human degree of creativity possible? And how did our creative capacity evolve? These are the two main questions to which I propose to sketch answers in this paper. To elaborate on them a little (in reverse order): Is our creativity a mere by-product of other selected-for traits (such as our language-capacity, or bigger brains)? Or was it selected for in its own right? And either way, what are its cognitive pre-requisites? That is to say, what had to be in place within our cognition initially, which either provided the sufficient conditions for our greatly enhanced creativity to make its appearance, or supplied the background against which some sort of disposition to engage in creative activities could emerge or get selected for?

I should emphasize that I only propose to *sketch* answers to these questions in what follows, and to provide inconclusive—but I hope plausible and suggestive—arguments in support of those answers. In an interdisciplinary and wide-ranging paper of this sort, it will not be possible to deal with the issues thoroughly, and much of the needed evidence is in any case lacking. My hope is to sketch out a framework for further enquiry, and to render it just plausible enough to encourage others to pursue these questions and to

seek some of the necessary evidence from the standpoint of their own interdisciplinary perspectives.

Any account of the evolutionary origins of creativity has to be consistent with the fossil record, of course. There is an emerging consensus that *Homo sapiens sapiens* first appeared some 100,000 years ago in Southern Africa. And there is evidence from about 90,000 years ago that this species was of basically modern intelligence, accumulating knowledge about its environment and making a number of important technological innovations; but that it was crucially lacking in creative imagination (Mithen [1996]). Although the working of wooden artifacts may have undergone some change, and bone tools were introduced for the first time, essentially the same range of stone tools as had been employed by later sub-species of *Homo erectus* continued to be used unchanged for tens of thousands of years. And there was little sign of the use of body-ornaments and no sign of the production of art (and little evidence of religion), until all these burst onto the scene (together with new stone-tool industries) some 40,000 years ago on a world-wide basis (Stringer and Gamble [1993]; Mithen [1996]).[1]

So far as we can tell from the archaeological record, then, human creativity first manifested itself to any significant degree about 40,000 years ago, continuing to emerge independently around the globe over the next 10,000–15,000 years. (This is the so-called 'creative explosion' of the Upper Paleolithic period.) The question is, what happened in the intervening 50,000-plus years from the first emergence of our species? The puzzle is compounded by the fact that by the time of the creative explosion human beings were already widely separated around the globe, and had been so for at least 20,000 years (with Australia having been reached by boat for the first time some 60,000 years ago). Yet this upsurge in human creativity occurred more or less simultaneously around the world (give or take 10,000 years).

These facts set one of the central puzzles which any account of the origins of creativity needs to address. It looks as if we shall *either* have to claim that human creativity resulted from a series of gradual cognitive/cultural accumulations, independent of genetic change and built up independently by different human communities over many millennia; *or* we shall need to claim that some change occurred in the human genotype which could be selected for independently of the nature of the ecological environment (as opposed to the universal aspects of the social milieu). Yet neither of these

[1] This view of the late emergence of creative culture is by no means uncontroversial, and the absence of evidence of such culture from earlier eras may in fact be an artifact of poor preservation combined with dispersed populations (Shennan [2000]). Moreover, there is at least some evidence of the use of red ochre (presumably for body painting) from around 100,000 years ago (Power [1999]; Watts [1999]). In what follows, however, I shall assume that the late emergence of creative culture is a genuine phenomenon—one which needs to be reckoned with by those proposing evolutionary explanations of human creativity.

alternatives looks initially very plausible. For on either account, how are we to explain why the relevant developments should have been constrained to take place in parallel amongst dispersed human populations?[2]

In what follows I shall canvass a number of possible explanations of human creativity, each of which carries different implications for the cognitive underpinnings and likely evolution of that capacity. These explanations will be assessed both for intrinsic plausibility and for how successfully they can explain the 20,000–50,000-year gap between the geographical dispersal of modern humans and the appearance of physical manifestations of significant degrees of creativity in the fossil record. But these accounts will also be assessed for the extent to which they can explain the connection between adult creativity and childhood pretend play. This *desideratum* will be elaborated and defended in the next section.

2 Creativity and Pretence

In addition to our remarkable learning-capacities, linguistic abilities and creativity, another salient species-specific fact about human beings is that the young of our species engage extensively in *pretend play* in infancy and childhood. From the age of about eighteen months all normal children, in all human cultures, start to do something which (when viewed from an external perspective, at least) appears very odd indeed—they begin to pretend. They engage in imaginary conversations with make-believe characters (talking to a doll; inventing an imaginary companion) and they pretend to be engaging in a wide variety of adult or fictional activities (talking into a banana as if it were a telephone; pretending to cook and eat mud pies; pretending to be a bird or an airplane). The young of no other species of creature on earth behaves like this in natural circumstances—not even the other great apes (although adult hand-reared and language-trained chimps have sometimes been observed to engage in activities which look very much *like* pretence, at least; see Jolly [1999]).

It is hard to believe that these two species-specific properties—adult creativity and childhood pretend play—are not intimately connected with one another, although it is true that they are not often discussed together.[3] I shall argue in a moment that the two capacities can be seen as sharing essentially

[2] This, then, provides one of the main motives for those wishing to deny the reality of the gap between the first emergence of anatomically modern humans and the appearance of creativity some 60,000 years later. But, as I shall hope to show, there is at least one plausible evolutionary explanation of the change which may have taken place in the human genotype during this time.

[3] For example, the Cambridge *Handbook of Creativity* (Sternberg [1999]) contains no references to pretence and only two references to play within its 400+ densely-packed pages, despite the presence of a whole section of papers devoted to the evolutionary and developmental origins of human creativity.

the same cognitive basis, in so far as both involve exercises of imagination. It will then be plausible that adult creativity in thought and action is what childhood pretence *is for*. (This will be yet another indicator of the importance of creativity as a phenotypic property of human beings.) That is to say, it will appear likely that the function of pretence should be to practice and enhance the kind of creativity which acquires so much significance in our adult lives. (This should not be taken as a claim about children's intentions, of course—they aren't *trying* to turn themselves into creative adults. Rather, it should be seen as a [tentative] claim about evolutionary and developmental *function*—the idea is that children are predisposed to engage in pretend play because this disposition helped their childhood ancestors to become creative adults, which in turn caused the genes responsible for that disposition to become general in the population.)

Although this suggestion needs to be worked out (a task to which I shall return in a moment), it does at least receive some preliminary support from comparative biology. For the young of all mammalian species engage in just the kinds of play which serve to practice, and are tailored towards, their distinctive adult behaviors. Thus kittens of all species of cat will engage in the sort of play-stalking, play-jumping and play-biting which will later be used when hunting; young male deer will take part in the kind of head-butting which will later be used in the competition for mates in the rut; the young of many prey species like gazelle engage in play-leaping and play-running of just the sort needed to escape from predators; and so on and so forth (Smith [1982]; Bekoff and Byers [1998]). By analogy, then, if we ask what human *pretend* play is for, the answer will be: its function is to practice for the sorts of imaginative thinking which will later manifest themselves in the creative activities of adults.

The connection between the two forms of behavior, arguably, is that each involves essentially the same cognitive underpinnings—namely, a capacity to generate, and to reason with, novel suppositions or *imaginary scenarios*. When pretending, what a child has to do is to *suppose* that something is the case (that the banana is a telephone; that the doll is alive), and then think and act within the scope of that supposition (Perner [1991]; Jarrold *et al.* [1994a]; Harris [2000]; Nichols and Stich [2000]).[4] Similarly, when adults are engaged in the construction of a new theory, or are seeking a novel solution to a practical problem, or are composing a tune, they have to think: 'Suppose it were the case that P', or 'Suppose I did it like *this*', or 'Suppose it sounded like *so*'. Given these commonalities, it does then seem plausible that the

[4] Leslie ([1987]) argues, in contrast, that what children need is the capacity to *meta-represent* their own representational states, hence 'de-coupling' them from their normal connections with belief and action. See Jarrold *et al.* ([1994a]) and Nichols and Stich ([2000]) for critiques of this view.

young of our species should engage in supposition-for-fun in childhood in order that they may be better able to suppose-for-real when they reach adulthood.

After a fallow period extending through much of the twentieth century, there is now an extensive psychological literature on the subject of human creativity. (See, for example, Langley *et al*. [1987]; Sternberg [1988], [1999]; Boden [1992], [1994]; Finke *et al*. [1992]; Weisberg [1993]; Smith *et al*. [1995]; and Amabile [1996].) Much of this has concentrated on what might be called 'successful creativity' or 'influential creativity', studied by examining the lives and circumstances of famous innovators in the arts, sciences and business worlds. As a consequence, those taking this approach tend to emphasize such factors as 'extensive background knowledge or training' and 'high levels of intrinsic motivation' in their analyses of creativity. For these qualities are shared almost universally by those who have succeeded in making a significant contribution to their chosen field of activity.

My interest, however, is in the universal cognitive underpinnings of normal (often mundane) human creativity, rather than in the qualities of character, motivation, or prior knowledge of those who excel in this respect. And here the two most important factors—whose relevance is acknowledged by all parties—are some sort of capacity to generate new ideas, on the one hand (e.g. by noticing a novel analogy), together with abilities to see and to develop the significance of those ideas, on the other. These factors are certainly accorded a fundamental role in one of the influential psychological accounts which is explicitly designed as a theory of universal cognitive creativity, the so-called 'geneplore' (for 'generate and explore') model of creativity developed by Finke and colleagues.

According to Finke *et al*. ([1992]), creative cognition involves two distinct stages. First, there is the generation of a novel hypothesis or idea—which at this stage is merely *entertained* rather than believed or endorsed—and then there is the exploration of that idea, developing it and working out its consequences, before finally accepting it or putting it into practice. (See also Finke [1995], and Ward *et al*. [1999].)

This two-stage account maps remarkably smoothly onto our best accounts of pretend play. An episode of pretence will begin with an initial supposition or imagined scenario—that the banana is a telephone; that the teddy-bears are having a tea party, and so on. The child then acts as if that supposition were true, following familiar scripts and/or drawing inferences appropriate to its truth in the light of their background knowledge—making dialing movements, say, or setting out the tea cups and saucers (Harris [2000]; Nichols and Stich [2000]). Often, too, yet further suppositions will be introduced into the play-episode, serving to elaborate and extend the pretence—for example, supposing that Granny has answered the phone-call

and hence beginning to talk to her; or supposing that there is cake to set out with the tea as well.

I shall return to the connections between creativity and pretence when proffering a positive account of their evolution in later sections. For the moment I conclude that it should be a constraint on theories of the evolution of our capacity for creative thought and action that they should proceed, at least in part, by explaining the evolutionary emergence of childhood pretend play. At any rate, it seems reasonable to take this as an initial working hypothesis, worthy of further exploration.

I shall turn, now, to canvass a range of different proposals which have been made concerning the evolution of human creative capacities. This discussion will, of necessity, be extremely brisk, serving mostly to motivate and set up my own thesis to be advanced in later sections.

3 Language and Creativity

Some people have claimed that possession of a fully-syntactic natural language is sufficient for the emergence of normal human creativity (Noble and Davidson [1996]). Those holding this view believe two things. First, they think that natural language is the vehicle for characteristically human thought and reasoning. And second, they think that the flexibility, recursive power, and creative potential of natural languages are what underpin the creativity of human thought and imagination. I am sympathetic towards the first of these claims, and have elsewhere argued that natural language sentences may be the vehicles of conscious propositional thinking (Carruthers [1996a], [1998b]; see also Mithen [1996]); and it is a claim for which powerful independent psychological evidence has now begun to emerge (Hermer-Vazquez *et al*. [1999]). Moreover, I shall suggest in Section 8 below that there is an element of truth in the second claim as well.

In addition, it might be claimed that this account can mesh nicely with the developmental data, since the appearance of pretend play at about eighteen months of age coincides with the 'language spurt' of extensive vocabulary acquisition. But this claim does not bear closer examination, for the proposal is that it is specifically *syntax* which is responsible for creative thinking, not just vocabulary. But eighteen-month infants have little grasp of natural language syntax, and their productions are confined to one or two-word unstructured utterances. Now, it may well be the case that infants' comprehension of syntax outstrips their productive abilities, and it might be claimed that it is the former which is specifically implicated in imaginative thought. (It is true of development in general that comprehension precedes production.) But it is actually doubtful whether infants' understanding of syntax is advanced enough to do the job required (Locke [1993]).

The real problem with this approach, however, is that (in view of the archaeological record) it is obliged to claim that language appeared very late on the evolutionary scene—*circa* 40,000 years ago, in fact. But given the geographical separation of different sub-groups of the human species well before the time when we first have significant evidence of human creativity, this account then seems required to postulate *either* that an innate language-faculty evolved in parallel amongst distinct groups of humans at about the same time, *or* that there is no innate language-faculty, and that languages are acquired using general-learning principles. Neither of these options is at all attractive.

Noble and Davidson ([1996]) opt for the latter alternative. Their view is that language is but one manifestation of a sort of generalized 'symbolic capacity' (other manifestations of which include paintings and tribal totems), which is underpinned by general intelligence, and which is to be understood in behavioristic rather than cognitive terms. (Noble and Davidson cite Ryle [1949] and Wittgenstein [1953] in their support.) This flies in the face of the Chomskian thesis that humans possess an innately channeled and informationally-structured language faculty (e.g. Chomsky [1988], [1995]), which is powerfully supported by a variety of different kinds of consideration (Pinker [1994]). But in any case it remains extremely puzzling that symbolic behaviors should have first made their appearance at about the same time world-wide, since the degree of geographical separation involved seems to rule out transmission by learning.

The alternative is that there *is* an innately-channeled language faculty, but that it evolved independently in geographically separated groups of humans. But this is no less implausible. First, this is because the language capacities of contemporary humans are near-enough identical; and all human natural languages are equivalent in terms of their basic expressive power (Pinker [1994]). Second, it is because the adaptations necessary to underpin language, on any nativist approach, are subtle and various—there needed to be physical adaptations to the mouth and larynx to facilitate the smooth production of speech; there were physical adaptations to the auditory system to enable speech to be processed independently of other sound; and there were a suite of language-specific cognitive adaptations for syntax, semantics and phonology, probably dividing into distinct production and comprehension systems (Pinker [1994]). It is beyond belief that a system of this complexity should have evolved similarly in isolated groups of humans, despite the wide variations in ecological challenges to which those groups would have been subject, and the differences in the social arrangements which they would have enjoyed.

I conclude, then, that the thesis that language is fully sufficient for human creativity is implausible. It will have to be claimed, rather, that something in

addition to language was needed for distinctive human creative behaviors to make their appearance.

4 Language and Cultural Accretions

On some accounts, possession of a fully-syntactic natural language is necessary but not sufficient for human creativity. These theories allow that full-blown human language (as opposed to the sort of a-syntactic 'proto-language' used by two-year-old children, which may also have been used by the Neanderthals and by Archaic forms of *Homo sapiens*) first appeared with the evolution of anatomically modern humans some 100,000 years ago in Southern Africa. What had to happen between that time and the creative explosion of c.40,000 years ago was *either* that the 'good trick' of almost-continuous auto-stimulation (talking to oneself) had to be discovered and catch on (Dennett [1991], [1995]; Bickerton [1995]); *or* that material culture had to develop to a sufficient extent to support creative activities (Sperber [1996]; Mithen [1998], [2000]). But both views at least agree that the emergence of human creativity depended upon a set of cultural accretions, in addition to language.

Dennett's view is now well known. Language first evolved as a medium for communication and public negotiation; but then some of our ancestors discovered that by asking themselves questions they could elicit information which they did not know that they had, and that by issuing themselves commands they could induce desirable behaviors. This 'good trick' gradually caught on and spread, and became internalized, eventually giving rise to what Dennett calls the 'Joycean machine'—the stream of inner verbalization and imagery which radically altered the computational powers of the human brain, and which gave rise to the indefinite flexibility and creativity of modern human intelligence.

This account faces essentially the same difficulties as the claim that language itself is a cultural accretion, discussed in Section 3 above. First, it is puzzling how the Joycean machine could have acquired basically the same form in geographically dispersed groups of humans by about the same time. This problem is further compounded by the second difficulty, which is that we lack any clear mechanism of transmission. The 'good trick' of auto-stimulation is supposed to be just that—a learned behavior. But it is mysterious how children are supposed to acquire it. No one ever *tells* them that it would be a good idea to engage in inner speech; and nor, of course, can they copy such behavior from observation of others. So it is by no means obvious how the Joycean machine is supposed to be transmitted down the generations. Nor is it clear how it could spread around the globe by contacts between adults. (Are we to imagine that hunter-gatherers from different tribes

meeting at a water-hole would think to *tell* one another that self-directed speech is a useful activity?)

In addition, Dennett's view cannot really make out a satisfactory connection between adult human creativity and childhood pretend play. For while it is true that young children will often talk aloud to themselves while they engage in problem-solving activities—which can plausibly be thought of as the precursor of inner speech (and hence of the creation of the 'Joycean machine')—such talk emerges substantially later than the first appearance of pretend play at eighteen months (Diaz and Berk [1992]). So it can hardly be the case that pretend play (like creative thinking generally, on this account) is made possible by the internalization of speech.

The alternative form of the 'cultural accretion' account of creativity emphasizes accumulations of *material* culture—particularly artifacts and/or enduring public symbols. In one version, what had to accumulate were semi-permanent externalizations of mentality, like paintings, statues, and notched-bone calendars (Mithen [1998], [2000]). But it is hard to believe that these could have been sufficient to give rise to creative cognition (let alone to pretend play).

Mithen ([1996], [1998]) does make out a strong case that what we see emerging in the fossil record for the first time c.40,000 years ago is concrete evidence of what he calls 'cognitive fluidity'—namely, the linking together of ideas across two or more cognitive domains or modules. We see figures which are half-human half-animal; the transformation of natural objects into bodily ornaments; ritual burial (suggestive of belief in after-life, which would involve a cross-over between the biological and mental domains); and the specialization of hunting weapons for different kinds of game. But this evidence is equally consistent with what will be my own proposal, that inter-modular transfer became possible with the evolution of language c.100,000 years ago, and that what was lacking until much more recently was the development of creative imagination. Whereas it is, in contrast, far from clear how an accumulation of material culture could facilitate creative thought.[5]

A more plausible hypothesis might be that it was accumulations of wealth (in the form of skills and improved tools, at least) which provided our ancestors with the free time in which to *be* creative (Sperber [1996]). On this account, the *capacity* for creativity was fully there from the advent of language 100,000 years ago; but it took a good many further millennia for humans to start using that capacity for anything other than practical problem-solving.

[5] Mithen ([1998]) suggests that externalizations of cross-modular ideas (in the form of a carved lion/man figurine, say) may be necessary to make them *memorable*, hence stabilizing them for the first time in human cognition. But actually the psychological evidence is that such ideas are *more* memorable than those which are familiar and mundane. See Boyer [2000].

This is certainly a possible view. And it could actually be combined with most elements of the account which I favor (see Sections 7–9 below), according to which a disposition towards pretend play was selected for in order to enhance adult creativity—only with the dates for this pushed back by 60,000 years or so to the first emergence of *Homo sapiens sapiens*. One significant problem with the view, however, is that it was not just 'frivolous' products like bead necklaces, cave-paintings, and ritual burials which underwent a revolution in the Upper Paleolithic; it was also the stone-tool industries (Mithen [1996]). The puzzle is that these shouldn't have undergone development earlier, if practical creative intelligence had been fully operative then.

5 Language, Play and Model-Building

According to Harris ([2000]), in contrast, the function of pretend play is to provide practice in mental-model building, essential for comprehension of discourse about the not-here-and-now. For in pretence what a child has to do is build on and elaborate their initial supposition into a more complete *model* of the imagined situation, drawing on relevant portions of their background knowledge; and in discourse comprehension, too, there is an extensive literature documenting the importance of mental-model building for successful understanding. In which case Harris may have to say that what occurred c.40,000 years ago was a leap forward in linguistic as well as in imaginative capacities.[6]

Would this commit him to claiming that full-blown language only made its appearance then, too? Probably not. Harris can allow that grammatical language was in place from the first appearance of *Homo sapiens sapiens* 100,000 years ago, and even that these humans had the capacity to talk about the not-here-and-now. He would just need to say that they were not very good at the latter. Before 40,000 years ago, humans could talk and comprehend effectively in relation to the here-and-now, but their abilities beyond that might have been slow and halting. What the drive towards pretend play in childhood then gave us was practice in the construction of mental models, which in turn enabled testimony in relation to the not-here-and-now to be much more effective.

The idea, then, is that the mental-model building involved in childhood pretence is practice for, and enhances, the sort of mental-model building necessary for text and discourse comprehension. As Harris rightly points out,

[6] Alternatively, Harris could combine his view with one or another version of the 'cultural accretions' proposals criticized briefly above, suggesting that although the full capacity for creative thinking was present 100,000 years ago, it was not much employed at that time for accidental cultural reasons.

this would not be a plausible evolutionary suggestion if we maintain the parallel strictly, and concentrate on adult comprehension of *fictional* discourse. (Or at least, not unless we were to buy into some story about runaway sexual selection—maybe males displayed to females by telling stories to them? See Miller [2000], for some suggestions along these lines.) So his actual proposal is that pretence helps with testimony. By building mental models of the non-actual in pretence, children are facilitated in their understanding of testimony about the not-here-and-now, which requires them similarly to construct a mental model of the described situation.

One worry about this idea is that pretence takes us one further remove from the actual situation than does testimony about distant events—it takes us, not just out of the actual current situation, but out of the actual world (considered as including distant parts of space and time). Why would we need to practice anything so radical in order to gain the desired benefit—namely, the capacity to construct mental models of the (presumed) actual world, albeit models of spatially or temporally distant parts of it? To put the point another way, why do children engage in pretence as opposed to sustained recollection of their pasts (requiring them to build and elaborate on mental models of actual events), or sustained speculation about distant ones?

Another problem is that it is far from clear why increased efficiency and flexibility in information-exchange (testimony) should lead to an explosion in the use of art and body-ornamentation. Why would an increased capacity to talk about past, future, or spatially-distant events express itself in cave-painting or the construction of bead necklaces? The connection is not perspicuous, to say the least.[7] (Though again, Harris might appeal to some version of the 'cultural accretions' accounts by way of defense.)

I think that Harris' functional speculation misses the key piece of information about pretence, in fact—namely, that pretending is a kind of *supposing*. To pretend that P is to suppose that P for fun, roughly speaking. And sustained episodes of pretence are best understood as episodes of thinking and reasoning within the scope of a supposition.[8]

[7] Ritual burial is another matter. If pretence facilitates testimony about the not-here-and-now and religion involves beliefs about the not-here-and-now, then it is easy to see how such activities might in principle be dependent on pretend play.

[8] I like to model this on those natural-deduction systems in formal logic which employ the device of indented lines, or brackets down the side of the page, to keep track of the scope of any assumption (e.g. Simpson [1988]). Within that scope you may not assert anything categorically, except what has been imported from outside—that is, which was already believed independently of the assumption. And only when the assumption is dropped again by conditionalization can new assertions get made. For example, one assumes P, proves Q from it together with background assumptions, and can then, outside the scope of the assumption, assert 'If P then Q'. Note, too, that such systems admit of multiple-embeddings of assumptions, just as new suppositions can get introduced into the scope of a pretence.

And if we ask what supposition is for, or what role it plays in our adult lives, the answer is pretty obvious, I suggest—it is a crucial tool in both practical and theoretical thinking. As practical agents we reason from suppositions all the time: Suppose I did this; what would then happen? What could I then do or get? And so on. As knowledge-seekers, too, suppositions play a crucial role. Without a capacity to suppose, neither science nor technological innovation would be possible, except on a trial-and-error basis. The main problem with Harris' proposal concerning the function of pretence, then, is that it breaks the very plausible connection between pretence and adult creative thinking and reasoning. For pretence is not for creativity but for testimony, on this account.

6 Creativity, Protean Cognition and Sexual Selection

Yet another proposal is made by Miller ([1997], [2000]). On this view, too, possession of fully-syntactic language may have been necessary, but was not sufficient for the emergence of human creativity. Creative cognition was additionally selected for, resulting from the sexual choices of both males and females, as a reliable indicator of reproductive fitness in general, and also as an indicator of *protean cognition* in particular. The claim, in effect, is that human creativity is our *peacock's tail*—a sexually-selected fitness-indicator. This is a complex proposal, which will require some unpacking before it can be evaluated.

Miller ([2000]) makes out a very plausible case for the importance of sexual selection in evolution generally (although its significance is frequently overlooked by those who are not working biologists), arguing that it is often the main driving force behind the divergence of species. Throughout most of the animal kingdom, sexual selection operates particularly upon males, since it is males who must compete for access to the limiting resource of female reproductive capacity, while it is females who must choose from amongst the competitors. But in pair-bonding species such as our own, sexual choice can operate on both sexes. For in so far as males are to commit their reproductive resources to one female, then they, too, will need mechanisms to ensure that they select wisely.

In general, sexually selected traits need to be reliable indicators of fitness. In consequence they tend to be costly to produce, hard to maintain, and to be highly sensitive to the presence of genetic mutations. (All are true of the peacock's tail.) Miller points out that displays of human creativity (in humor, in story-telling, and in status-enhancing activity generally) satisfy at least the first two of these requirements, being dependent, as they are, on the healthy functioning and distinctive size of the human brain. For our brains take many years to grow to maturity, and are extremely costly to maintain in terms of

their energy requirements (accounting for 40% of the body's glucose consumption, for example). In addition, Miller thinks, there was probably sexual selection in hominids for honest advertisements of *protean cognition*, of which the most obvious are partly-random displays of creative thought. And if creativity is being selected for, then there will be selection for anything—such as childhood pretend play—which serves to enhance it. So the connection between adult creativity and childhood pretend play can be adequately explained.

Miller ([1997], [2000]) argues that there would have been powerful selective pressures acting on socially-competitive mind-readers to make themselves genuinely unpredictable in certain kinds of competitive situation. Consider an alpha-male primate concerned to protect his access to the females of the troupe, for example. What strategy should he adopt in response to challenges to his authority? One option is to punish each and every transgression, large or small. But this would be very costly in terms of both time and energy. Another option is to set a threshold in the spectrum of potential challenges, below which challenges are ignored, but above which they are punished. The trouble with this strategy, however, is that the other males will rapidly learn what the threshold is, and so will know that they can flout his authority with impunity below it.

A better strategy than either of the above—and which Miller dubs 'Mad Dog'—is unpredictability. (Note that this strategy is actually observed in nature, in these sorts of circumstances, amongst both apes and human despots.) The alpha-male will only punish *some* transgressions (thus minimizing the costs to himself), but it will be unpredictable *which* ones he will punish, or how frequently. He thereby provides a powerful incentive against *any* transgression, while at the same time spreading uncertainty amongst his competitors. And the best way for him to be able to do this is if he can somehow make his responses genuinely random, or *protean*, in such a way that they cannot be predicted even by himself.

In fact Miller makes out a powerful case that alongside the selection pressures building mind-reading abilities in primates and hominids, and developing in tandem with them, there would have been pressures for hominid cognition to become *protean* in a variety of competitive conditions.[9] With a capacity for protean unpredictability becoming closely linked to reproductive success, there might have been a further pressure—this time in the form of sexual selection—in favor of *honest displays* of proteanism. And

[9] This is a proposal which deserves to be worked through thoroughly by both philosophers of mind and developmental psychologists, since in both disciplines there is a tendency to equate unpredictability with either noise or mere ignorance of initial conditions. But if Miller is right, then at least some forms of unpredictability will go much deeper into the human psyche.

this might then have manifested itself in various forms of human creativity, and in a valuing of novelty.

But what of the time-scales involved in this proposal? How can Miller handle the 60,000-year gap before the 'creative explosion' of the Upper Paleolithic? He *could* claim that what happened between the advent of language c.100,000 years ago and the creative explosion of c.40,000 years ago was a genotypic change resulting from sexual selection, which could thus have occurred in a manner which was independent of the different environmental conditions experienced by geographically-dispersed groups of humans. Against this, however, is the point that sexual selection in dispersed groups tends to result in between-group differences in the sexually-selected traits, since small initial disparities in the initial preferences become greatly amplified over time. (Note that sexually-selected human bodily traits—such as body hair, as well as breast, buttock and penis size—*do* vary significantly between different human groups.) But there is no evidence of between-group differences in creativity.

As a result, what Miller ([2000]) actually does is deny the reality of the gap between the first appearance of our species and the emergence of creative behaviors. He joins those who wish to claim that the appearance of such a gap is a mere artifact of a variety of factors conspiring to hide the evidence of earlier forms of creativity from us. This is certainly a possible position; and he may well turn out to be right. But my project in this paper is to see what can be done if we take the existence of the 'creativity gap' seriously, and attempt to accommodate it (rather than deny it) in our accounts of the emergence of distinctive human creativity. Accordingly, from this perspective, Miller's proposal is not an acceptable one.

7 The Evolution of Pretence

On the view that I favor, and which has begun to emerge from the above discussion, all of the cognitive pre-requisites for creative thought were in place from the first emergence of anatomically modern humans. What then happened between that time and c.40,000 years ago was that there was selection for a childhood disposition towards pretend play. The cognitive pre-requisites for pretence were in place from at least the advent of language, I suggest; but actually *engaging* in frequent pretend play in childhood served to practice and enhance our imaginative abilities.

Why was this selected for? Not, I suppose, because exercises of imagination are an indicator of protean cognition; but rather because they are partially constitutive of *intelligence*, in the sense of general problem-solving abilities. But the selection-pressure can still have been sexual (operating equally between the sexes) rather than environmental, just as Miller ([2000]) argues;

or it could just as well have been environmental; or it could have been both of these operating together. On any of these three possibilities, there will be no particular problem in explaining the co-evolution of pretend play in dispersed populations.

If the selection pressure for pretend play was sexual, we just have to suppose that early humans had the capacity to discern the connection between imaginative abilities and problem-solving success. This seems perfectly plausible, since everyone is agreed that these humans would have had highly-developed forms of causal understanding, as well as fully modern mind-reading abilities, in addition to language. Then children who happened to be more disposed to engage in pretend play in childhood would grow up to become more imaginative/intelligent adults; and this quality would then be perceived and valued by potential mating partners of the opposite sex, leading to greater reproductive success.

Note that one important difference between this proposal and that of Miller ([2000]) is that the preference for creative partners need not itself be innate, but results rather from the human capacity to detect the causal connection between creative thinking, on the one hand, and problem-solving success, on the other. There is therefore no reason to think that small initial differences in this preference between dispersed populations would have been consistent enough to amplify over time, leading to significant differences in creative abilities between different human groups. Consistent with this hypothesis, a large cross-cultural study of patterns of human mate-preference found that in all of the 37 cultures studied, both men and women rated intelligence high amongst the desirable characteristics of a potential mate (Buss [1989]).[10]

Alternatively, we might think that pretend play was selected for because those who engaged in it (or who engaged in it more) subsequently proved more successful in problem solving (and so in surviving and reproducing) when they reached adulthood. Since what was being enhanced here is a creative problem-solving capacity which can operate across wide variations in environment, the fact of such variation need provide no obstacle to parallel selection. Or in addition (and perhaps most plausibly) both reproductive and environmental pressures might have operated at once.

[10] The author of the study was surprised by this result, having expected that male desire would be driven almost entirely by signs of fertility in women (i.e. by 'beauty'). But he should not have been. In hunter-gatherer societies today, female reproductive success is determined much more by resourcefulness than by fertility, and many women do not succeed in raising more than a single child to reproductive age (if they succeed in raising any), despite giving birth to many infants (Hrdy [1999]). The same was probably true throughout our evolutionary history. Small wonder, then, if men, too, should always have valued intelligence and problem-solving abilities in a potential long-term mate.

8 The Emergence of Supposing

What sort of cognitive architecture would have had to be in place 100,000 years ago, on this account? On the model of pretence proposed by Nichols and Stich ([2000]), humans would have needed two distinct cognitive elements. First, they would have needed a supposition-generator, or 'supposer', to create representations of imagined possibilities.[11] And second, humans would have needed a 'possible worlds box', which is a memory system designed to store suppositions and their elaborations during the course of a pretend-episode.

Now, I doubt whether there is any reason to think that the 'possible worlds box' required the creation of any new adaptation. Surely, already-existing working-memory systems could have been co-opted for the job. But the supposition-generator is another matter. For on this model it looks as if it would have required the creation of a whole new type of propositional attitude (distinct from either belief or desire, nor reducible to combinations thereof) in order for imaginative thinking and/or pretend play to make its appearance in the hominid lineage. This might then be taken to suggest that it would have required some powerful selectional pressure in order for imaginative thinking to become possible. But actually there is some reason to think that imagination comes in at least two forms, each of which would be provided 'for free' by the evolution of other faculties. Let me briefly elaborate.

First, there is *experiential* imagination—namely, the capacity to form and manipulate images relating to a given sense modality (visual, auditory, and so on). There is some reason to think that a basic capacity for this sort of imagination is a by-product of the conceptualizing processes inherent in the various perceptual input-systems. There are extensive feed-back neural pathways in the visual system, for example, which are used in object-recognition when 'asking questions of' ambiguous or degraded input. And these very pathways are then deployed in visual imagination so as to generate quasi-perceptual inputs to the visual system (Kosslyn [1994]). Evidence from cognitive archaeology (concerning the imposition of sophisticated symmetries on stone tools, which would have required a capacity to visualize and manipulate an image of the desired product) suggests that this capacity would have been present about 400,000 years ago (Wynn [2000])—i.e. considerably before the evolution of full-blown language, if the latter only appeared some 100,000 years ago, as many believe.

Second, there is *propositional* imagination. This is the capacity to form and consider a propositional representation without commitment to its truth or

[11] Nichols and Stich ([2000]) actually label this element 'the script elaborator'. This name is misleading, since it suggests that the supposer is only involved in *elaborating* sequences of pretence which are already in train; whereas they actually intend it to have the function of generating initial pretences as well (personal communication).

desirability. There is some reason to think that this capacity comes to us 'for free' too, this time with language. For a productive language system will involve a capacity to construct new sentences, whose contents are as yet neither believed nor desired, which can then serve as objects of reflective consideration of various sorts. In which case a capacity for propositional imagination is likely to have formed part of the normal human cognitive endowment for about the last 100,000 years at least.

Of course a mere capacity for creative generation of new sentences (or images) will not be sufficient for imaginative thinking as we normally understand it. For there is nothing especially imaginative about generating any old new sentence or image. Rather, we think imagination consists in the generation of *relevant* and/or *fruitful and interesting* new ideas. And such a capacity will not come to us 'for free' with anything. But then this is precisely the developmental function of pretend play, on the present proposal—through frequent practice, to help build a consistent disposition to generate novel suppositions which *will* be both relevant and interesting.

In any case, the *supposer* need not be an additional cognitive faculty, with any distinct neural realization. It just has to be the possibility of taking a distinct (non-judgmental, non-evaluative) *attitude* towards contents—namely, the attitude of *supposing*. But, arguably, we get this attitude for free with imagery and language. What these faculties give us is the capacity to frame and then consider a possibility (represented by a visual image, say, or by a new sentence), without yet endorsing, rejecting, or desiring it. Once we have this, we effectively have the capacity to suppose.

So both pretend play and creative adult thinking would have been *possible* from around 100,000 years ago, I suggest. But it then took some 50,000–60,000 years for a strong disposition towards pretend play in childhood to become established in the human phenotype, thus leading to greatly enhanced creative thought and behavior amongst adults as well, and hence leading to the Upper Paleolithic 'creative explosion'.

9 Pretence and Motivation

What is the source of children's disposition towards pretend play, however? Is it possible to say more about the mental mechanism which produces and rewards the activity of supposing? In Carruthers ([1996b]) I suggested that children are wired up so as to detect, and then receive intrinsic gratification from, acts of supposition as such. This account was intended to explain the *absence* of pretend play in children with autism—a condition which I assume (following Leslie [1993], and Baron-Cohen [1995]) to be a kind of 'mind-blindness' resulting from damage to a developing mind-reading module. For

although autistic children rarely engage in pretence spontaneously, they do appear to retain the *capacity* for it, and can generate pretend episodes when prompted to do so—they just don't normally do it because they don't see the point (Lewis and Boucher [1988]; Jarrold *et al*. [1994b]). My suggestion was therefore that it might be the supposition-detector which is damaged in autism, where this detector can be thought of as an element in the normal mind-reading system.

The problem with this account, however, is that it attributes precocious mind-reading abilities to normal eighteen-month-olds (as Nichols and Stich [2000] correctly point out). There is plenty of evidence that such children have a developing understanding of agency, and of desire and perception as non-intentional relations between agents and objects (Wellman [1990]; Gopnik and Melzoff [1997]). But there is also powerful evidence that children under three do *not* have any conception of mental states as such, considered as subjective representational states of the agent, which may represent objects partially or incorrectly (Wellman [1990]; Perner [1991]). So it seems unlikely that an eighteen-month-old infant would be capable of representing its own state of pretending, as such.

A better proposal is that the rewards for pretence derive from engagement with, and quasi-satisfaction of, the agent's first-order goals and interests. For notice that imagination in general seems to be connected up with the appetitive and motivational systems in something very like the way that belief is, as Harris ([2000]) demonstrates at length. As is familiar, imagined sex can make you feel sexy, imagined insults can make you angry, imagined food can make your mouth water, and so on. This is the basis of the enjoyment we take in story-telling, cinema, and works of fiction—imagining doing and experiencing interesting things is itself interesting.

The satisfactions to be derived from pretend play are essentially the same, I suggest. Suppose that you find telephones fascinating, as young children often do (they are of manifest importance to adults, but eighteen-month-olds are rarely allowed to use them); and suppose that you also like to talk to your granny. Then by imagining that the banana is a telephone, and by representing yourself as making a call, you can gain some of the motivational rewards of the real thing; as you can by imagining that your granny has answered and is there to be talked to. Ditto for imaginary friends, making mud pies, and pretending to be a bird or an airplane.

This proposal still leaves us in a position to explain why autistic children do not normally engage in pretend play, however, despite having the capacity to do so. We just have to suppose, first, that such children will have a weakened or damaged conception of agency, resulting from the delayed or damaged development of their mind-reading module; and second, that enjoyment of

pretence requires the capacity to represent one's own agency. Let me try to substantiate these points in turn.

The first point is easy, since it is well-established that autistic infants lack a normal sense of agency. Indeed, amongst the most reliable diagnostic criteria for autism in young children are a tendency to treat other people as *objects* (using adults as mere items of furniture; leading adults by the hand and then pushing their hands in the direction of a desired object), and an absence of shared-attention behaviors (lack of pointing and 'social referencing'; a failure to read and react appropriately to behavioral cues such as eye-direction; and so on). Even if all children at the age of two will lack any conception of their own and others' mental states as such, normal children will, and autistic children do not, have a robust conception of themselves and others as agents, and routinely represent the goal-directed nature of the actions of those agents (Baron-Cohen [1995]; Gopnik and Melzoff [1997]).

To see the second point—that enjoyment of pretence requires a capacity to represent one's own agency—think again of the child using a banana as a telephone. The child is not actually making a telephone call, of course; so there is nothing in the movements which she makes, as such, to engage with her desire to do so. In order to gain any satisfaction, the child must represent the movements of her finger while she stabs at the banana *as* an act of dialing; and she must represent the movements involved in putting the banana to her ear *as* the act of holding a telephone in such a way as to hear and be heard; and so on. This surely requires a capacity to categorize bodily movements as goal-directed actions—which is just the capacity which autistic infants appear to lack.

I have explained how the rewards for pretence derive from the connections between our motivational systems and imagination in general; and I have explained why those rewards may not be available to 'mind-blind' autistic children. But now it might begin to look as if I have explained too much. For the rewards for pretence (as well as the capacity for it) now also appear to emerge as a mere by-product of other faculties. In which case the gap which I supposed to exist between the appearance of the *capacity* for pretence and for creative thought 100,000 years ago and the emergence of a regular *disposition* to engage in it will disappear.

But actually, we still need to explain why children should ever *start* to pretend in the first place. The above discussion only purported to explain why they should continue to do so once they begin. So what may have developed between the first emergence of our species and the 'creative explosion' of c.40,000 years ago is a strong childhood disposition to generate new suppositions, and a disposition to begin thinking and acting within the scope of those suppositions. This disposition, once activated, would yield its own rewards through the connections between imagination and the motivational

system. And its regular activation would serve to practice for adult uses of supposition in theory-building and problem-solving.[12]

10 Two Objections

My account might seem to be subject to (at least) the following two objections. Seeing how these objections can be answered will lead to further clarification and elaboration of my proposals.

First, how is it that the account isn't vulnerable to one of the objections raised against Harris' proposal in Section 5 above (the proposal, namely, that pretence is to enhance our comprehension of discourse about the not-here-and-now)? For pretending can take us, not just outside of the actual situation, but outside of the real world. Pretence can be mere fantasy. But if pretence is for enhancing our problem-solving abilities, this might seem puzzling. For such abilities are always exercised in, and tied to the parameters of, some real situation.

This objection is relatively easy to answer, however. For it is no part of my story that creative thinking is only useful in practical reasoning about known aspects of the real world. On the contrary, it is equally valuable in enabling us to generate novel explanations and hypotheses, about the unseen causes of observed events, say. Such hypotheses are distinguished from fantasy only in being *directed at* the real world. In other respects they can take us entirely outside of the world of our prior knowledge or experience, just as fantasy can. For example, hunters tracking a wounded animal will often have to generate highly speculative hypotheses in order to interpret the subtle signs they observe—a capacity which bears striking resemblances to the sort of creative thinking which goes on in hypothesis-generation in contemporary science (Liebenberg [1990]; Carruthers [2002]).

The second and more challenging objection is this. If the selection-pressure which led to a childhood disposition to engage in pretend play had to do with enhancing imaginative thinking in adulthood, as I claim, then it is puzzling that what should have resulted is a disposition to *play* (involving overt movements) rather than to fantasize. Why waste energy (and sometimes risk injury!) by *pretending* to be a bird, if *merely imagining* being a bird would have served the developmental purpose just as well?

One sort of answer might be that, at the age when pretend-play first starts to emerge, young children do not have the sort of introspective access to their own mental states which would be necessary for enjoyment of mere

[12] Alternatively, we could suppose that the connections between imagination and the motivational system became strengthened with time, in a kind of mutually reinforcing loop. Perhaps the pleasures to be derived from pretence 100,000 years ago, and from imagining desired activities and experiences, were much less than they are now.

imagination (Gopnik [1993]; Carruthers [1996b]). But this would really only defer the problem. For why is it then crucial that imagination-enhancing activity should begin at eighteen months rather than later in development, given that imagination will only begin to enhance fitness considerably later?

A much more plausible answer can be arrived at by noticing that play *activity*—e.g. of a rough-and-tumble sort—would almost certainly have existed already in the repertoire of human infants, just as it does in the infancy of all other mammals. Then as so often happens in evolution, this pre-existing disposition may have become harnessed to serve the development of creativity, with a disposition to engage in *play* activity now becoming a disposition to engage in *pretend* activity. And there may well then have been selection pressures sufficient to prevent the attenuation of any overt active component (perhaps also combined with a shift to later in development, in light of the point made in the previous paragraph). For example, overt pretence can easily become shared pretence, which would not only have benefits for the development of the mind-reading faculty, but can also be useful in building alliances and honing social skills generally. Moreover, by combining *pretence* with *activity*, children can continue to develop the sorts of physical skills (e.g. those involved in controlling and manipulating objects) which will also be useful in adulthood.

11 Conclusion

My goal in this paper has been to render plausible a number of inter-linked claims. I have tried to convince you of the following, in particular. First, that childhood pretend play and adult creative thinking and problem-solving share the same cognitive basis, namely the capacity to generate an initial supposition, and to think and reason within its scope. Second, that the evolutionary function of pretend play is best seen as practice for adult creative thinking. And third, that what got selected for between the first appearance of anatomically modern humans c.100,000 years ago and the 'creative explosion' of c.40,000 years ago was a disposition to engage in pretend play in childhood. I have suggested that these claims, taken together, constitute a hypothesis which is more plausible than any of the competitors currently on the market. It is a hypothesis which is surely worthy of further interdisciplinary investigation.

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