

## Preface

### Reassembling the Bones

The greatest enterprise of the mind has always been and always will be the attempted linkage of the sciences and humanities.

E. O. Wilson, *Consilience*

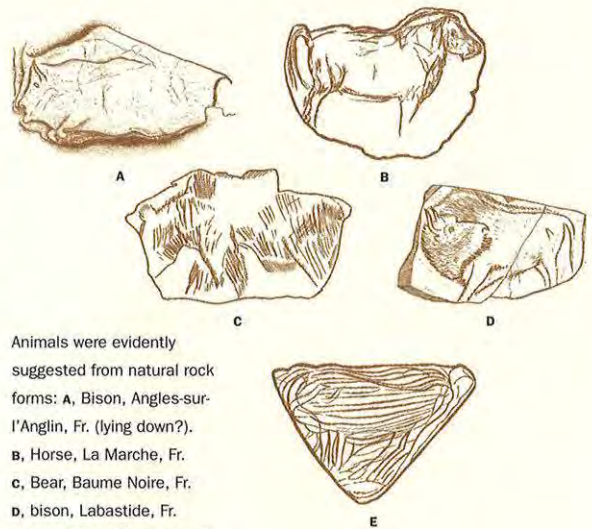
The term "Paleolithic art" has fuzzy edges, but I use it to refer to art made during the late Pleistocene, from 10,000 to 40,000 years ago. Thousands of pieces of this typically representational art exhibit a striking integrity of style and subject matter. The character of this integrity and the origins of this art, as well as its changes with the end of the Pleistocene, are among humanity's most fascinating subjects. Let me begin by telling you how I got into all of this.

In 1979 I was invited to a symposium in Sigriswil, Switzerland, that included many scholars working in Paleolithic art. H.-G. Bandi, a Swiss archaeologist, was the organizer of the meeting. Bandi and I had met several years earlier when his work brought him to Alaska. He invited me to the conference as a naturalist, an artist, and paleobiologist familiar with Pleistocene animals represented in Paleolithic art. He had the vision that there was a potential access to Pleistocene natural history in these drawings if we but could bring it into focus (Bandi et al. 1984). I agreed and enthusiastically accepted Bandi's invitation. My previous research had focused on northern Pleistocene mammals—the mammoth, horse, and bison species featured in Paleolithic art—and I had already begun work-

ing with Paleolithic art in the way Bandi envisioned. So I prepared an illustrated talk outlining several new themes in Paleolithic natural history. But the meeting was taut with an unaccountable underlying tension and at its close I left quite puzzled.

I have come to understand the differences among us at that Sigriswil meeting pertained less to the detailed questions we discussed than aspects of our respective orientations and assumptions. In that meeting hall, with the bright spring alpine panorama of melting snow out the window, we sat on opposite sides of a dividing aisle as in C. P. Snow's *Two Cultures* (1959): those interested in the symbolic significance and spiritual motivations behind the art and those looking into the art for clues to life in the past. It was my first experience with this kind of dichotomy in scholarship.

Until then, I had looked at Paleolithic art both to appreciate the colorful renditions and to find useful and interesting details about Pleistocene animal anatomy. But the experience of that conference set me on a new course of trying to place Paleolithic art in a larger dimension of natural history and of linking artistic behavior to our evolutionary past. This book addresses common ground

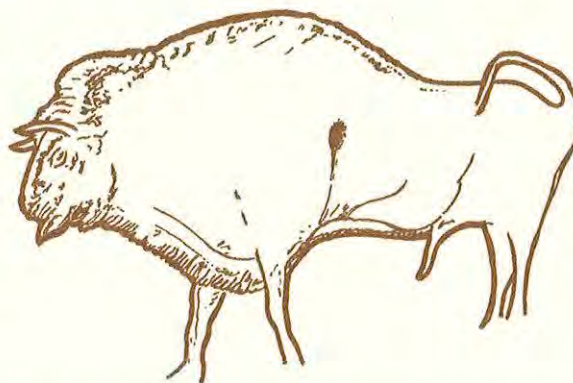


Animals were evidently suggested from natural rock forms: A, Bison, Angles-sur-l'Anglin, Fr. (lying down?). B, Horse, La Marche, Fr. C, Bear, Baume Noire, Fr. D, bison, Labastide, Fr. E, bison(?) La Madeleine, Fr.

shared by the humanities, social sciences, and natural sciences—attempting to step across Snow’s aisle and try to fit all these interests together in a consilient manner. So it is an idea book, obviously not the normal, colorful, coffee-table sort but a new kind of investigation of Paleolithic art that develops insights into the natural history of art making and the nature of creativity—using our human nature to understand this old art and using this old art to understand human nature. I have tried to present all of this accessibly and artfully, because these ideas should be interesting to most people.

Over the last two decades, I have been able to examine most of the thousands of images that make up our collection of late Paleolithic art. Contrary to popular literature, many Paleolithic works do not seem to bear any obvious imprint of ritual and magic but, rather, express more casual and earthy themes. The majority were done quickly and are contingent and undisciplined, with overlapping, incomplete, and often askew imagery. I found details in which I was originally interested coalescing into unanticipated patterns. There are many unskilled Paleolithic drawings that are rarely reproduced in art books. Forensic work with fossil handprints of the artists greatly changed the way I looked at this art: I found that all ages and both sexes were making art, not just senior male shamans. Throughout all of this, my interests in the evolutionary and behavioral patterns of woolly large mammals turned into a study of Paleolithic artists and the evolution of their art.

For me, to recognize that so many of the preserved Paleolithic images were done casually, by both sexes and all age-groups, more often than not by youngsters, who even left their tracks under renditions of wounded bulls and swollen vulvas, in no way makes Paleolithic sites less hallowed. The possibility that adolescent giggles and snickers may have echoed in dark cave passages as often as the rhythm of a shaman’s chant demeans neither artists nor art. Instead, it opens the possibility for us to conceive, with familiar warmth and greater immediacy, the entire range of preserved Paleolithic art. Indeed, as I will argue,



Engraving of fairly young bison bull from Altxerri Cave, Sp., pictured with weight on right front foot. Details are informative. Many images of large mammals include a bleeding thoracic wound. This bison appears to be a mortally wounded animal, tail up in mild alarm and pain, erection showing his ligamentous penis, specific to artiodactyls. The enlarged dorsal neck mane is characteristic of Pleistocene bison from southern Europe. This is a fine work by an experienced observer and artist.

our collection of this art is to a great extent a distorted sample. Preservational contexts, I propose, sometimes favored the art making of people whose technical art skills were not yet polished. I hope to make such neglected and underplayed aspects of Paleolithic art better known and appreciated.

My main conclusion is that preserved Paleolithic art, unlike most “tribal art,” is a graphic expression whose articulation we can largely comprehend, and that the perspective of natural history offers an essential dimension to that appreciation; it is the “code-breaker.” Paleolithic artist-hunters were keen students of natural history—they had to be. Their art is not an obtusely symbolic language but something very deep and very dear. Across a span of 30,000 years and despite the many different cultures that likely existed in western Eurasia during the late Paleolithic, their art displays a striking unity and is readily distinguishable from later, post-Pleistocene tribal art.

I began with Paleolithic art hoping to use it as a window into the Pleistocene, then came to realize that it is both a window and a mirror. And it is peculiarly distorted as both. It lets us see some things and obscures others,

with distortions that are to some degree identifiable. Looking at Paleolithic art as a mirror sometimes lets us glimpse ourselves in the reflected fears, play, delights, and preoccupations that are drawn there. And this mirror, tens of thousand of years old, also reflects our animal-involved past. After all, watching other large mammals is one of the oldest intellectual, as well as aesthetic, human endeavors. We can see that the makers of these images were addicted animal watchers.

I depend a great deal in this book on our animal being, the animalness we share with other large mammals, and in developing my lines of thought about human universals, I will rely on the common evolutionary past that we share with Paleolithic peoples. Tastes in art to a degree do

disclose character, both individually and for the groups to which we belong. And because this is so, we can pick among archaeological remnants to reconstruct imagination as well as artifact. There is much variety and a good measure of contingency in this old art, but out of it we can develop a little order, some principles, and more than a few insights.

The story I have to tell is not simple, and I hope you will bear with me, because my lines of evidence, like characters in a Russian novel, do weave among one another: evolution gets entangled with the natural history of hunting, love, nurture, the erotic, graffiti, creativity, youth, sexual differences, science, myth, and mystery. We'll meet all these influences as the story unfolds.

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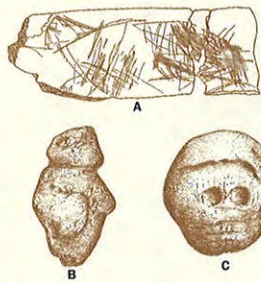
## The Evolution of Art Behavior in the Paleolithic

One of the great mysteries of human evolution is the sudden outburst of art of a very high quality in the Upper Paleolithic.

Julian Huxley, in D. Morris, *The Biology of Art*

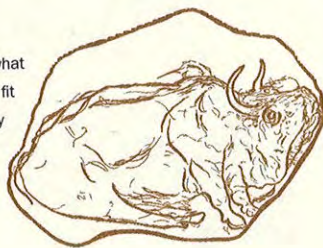
### *Homo aestheticus* né *Homo ludens*

The origins of art making have always been a mystery. Art is such a marvelous human peculiarity, so distinctive of our kind, and yet it is remarkably unilluminated by a century of evolutionary inquiry. The latter has generally exhibited a blind eye to the organic nature of art making and has tended to stall out when faced with this aspect of human life, stiffly saying art must be an epiphenomenon, some inexplicable evolutionary spin-off of being human. But let us look again at the *nature* of human art making, this time through



I have emphasized the bloom of visual art in the last 40,000 years, but that is not to say that some underlying dimensions of this behavior were not there long before. There are small scraps of early fun among artifacts from hundreds of thousands of years ago. A, Bilzingsleben, Ger. B, Berekhat Ram, Israel. C, Makapansgat, R.S.A. The subjects chosen even back then should be familiar to you.

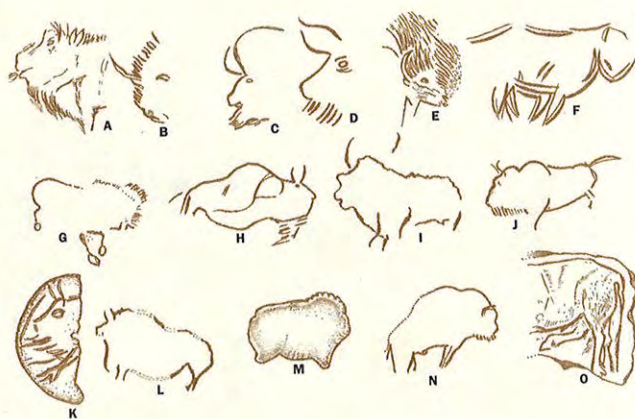
We have seen that people drew what was on their minds, a stone to fit every bison, or a bison to fit every stone. But why engrave bison on stones in the first place? La Marche, Fr.



the wider aperture of natural history's lens. This approach has provided insight into organismal order underlying human patterns in courting and mating, nurturing babies, raising children, securing food, competing, and cooperating and sharing. We can readily see links to genetic fitness as well as ways in which our patterns in these matters are related to counterparts in other mammals.

Approaching the problem from that angle may reveal that art making has adaptive roots. Can we talk about an evolutionary history of art making as we might trace the history of gall bladders or nesting behavior? Is there anything a natural historian can contribute to the discussion of why Paleolithic folks were scratching forms in ivory and mixing ocher to paint on walls, decorating their clothes and tools, and coiffuring their hair? A natural historian's presumption of some coherence in these choices is not based on ideas of natural perfection nor is it a reductive nothing-but-biology view. It is rather a respect for the deep consilience which only time can render.

The abundance of art from the late Paleolithic challenges more utilitarian notions of productive and purposeful activity. Couldn't those painters have been making a warmer house or taking out the garbage to make a health-

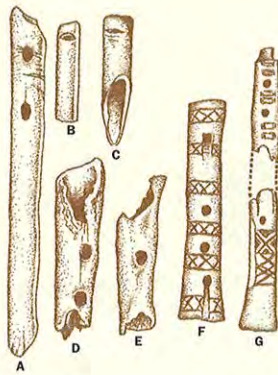


At a different level we can ask why were these people of all stages of development and experience making any kind of art? A, Rochereil, Fr. B and E, Gabillou, Fr. C and H, Altamira, Sp. D, Niaux, Fr. F and K, Isturitz, Fr. G, Villars, Fr. I, Abri de la Souquette, Fr. J, Montespan, Fr. L, Mayenne-Sciences, Fr. M, Vogelherd, Ger. N, Nancy, Fr. O, Labastide, Fr.

ier campsite? Surely, there was more directly productive work always waiting to be done. Perhaps our attachment to practical activity is why scholars have so repeatedly sought and speculated on the *purposes* of this old art—wondering whether these images were made to please the gods, to bless hunts past or those to come, to dramatize a shaman's visions and hallucinations, or to initiate youngsters. Could this insistent pursuit of art's purpose be mistaken? Is it conceivable that art making advanced reproductive fitness in a different way from time spent repairing the weirs or producing extra raingear for emergencies?

I think so, and propose to sketch from my perspective the immense evolutionary importance of art making and its enjoyment in our human lineage. Indeed, those behaviors are so much a part of our experience that they are not readily apparent. Therefore, I will try to lay out the case that we are an art-making animal.

By "art making" I mean a certain class of actions that are not overtly necessary for the operational demands immediately linked to reproductive fitness. This broad sense of art would include many activities that appear to be just "playing around." And, in fact, that is my thesis, that art making is a uniquely evolved offshoot of play. Ethologists



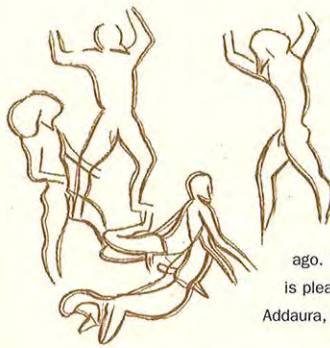
There is evidence that art was connected with play even in the Paleolithic. They made music using decorated musical instruments. Paleolithic flutes and whistles: A, Pair-non-Pair, Fr. B-C, Roc-de-Marcamps, Fr. D, La Garrigue, Fr. E, Lascaux, Fr. F, Tütpatz, Ger. G, Hungate, England.

recognize that play is a complex adaptive trait and is an important feature in the biology of many species.

We know that some human play is similar to the play of other animals: rough-and-tumble fighting play, playing with objects, sexual play, locomotor play, social play, and so forth. But human play ranges wider and is very diverse. By human play I include not only the many things we recognize as child's play but also team and solo sports, humor, perhaps recreational shopping, and even daydreaming—particularly daydreaming, that rich fantasy world which consumes so much of one's day. In fact, new evidence might even include night dreams.

Later we will look at how play occurs in specific adaptive modules, or clusters (e.g., social play, locomotor play), that activate innovation and serve as practice for adult behavior. The human niche demanded a whole new level of innovation and imagination, requiring a radically new module beyond play. I will propose that art making in its most comprehensive sense is that module. In that role, though it apparently evolved as a transformation of more familiar primate play modules, art making functioned to activate and flex uniquely human creative capacities.

Though art making can appear to be closely related to other kinds of human play, and perhaps can arise in hu-



A Paleolithic wrestling match? We do not need images like this to know that young men played rough games of fun and power tens of thousands of years ago. It is one of the human universals, but it is pleasing to see that truth engraved so boldly. Addaura, It.

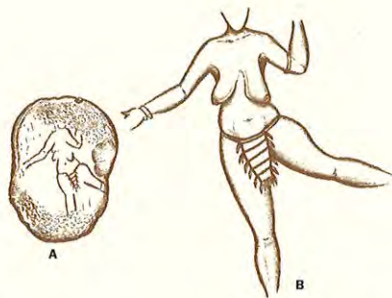


Pleistocene players? La Marche, Fr.

man play at any moment, I would like to distinguish art making as a kind of magnified play; it is play that creates and inhabits, as it were, a new and distinctly human dimension. The adaptive forces we see in play are magnified in art—you might imagine it as play-squared. Art making entails a vivifying awareness of the stuff of life. It is the concrete expression of aware experience and imagination, creating unique "art-stuff" that can be oil on canvas, music or story, sculpture, dance, fine food, play, poem, novel, movie, or a body made more interesting by dress, grooming, and other adornment. Much art is also involved in designing, making, and maintaining a pleasant shelter and surroundings. Architecture creates a "place" or fails to create one. And, certainly, art making is present or fails to be present in the sciences and other scholarly fields.

Let me add the obvious, if less easy to articulate, corollary: there is another sort of creative-vivifying event going on whenever we receptively engage a form of art-stuff—when we listen to another's story or music, when we appreciate someone else's good meal, a wonderful streetscape, or a scientific or historical insight, when we read a poem or enjoy a novel. Art making and art appreciating feed on one another; the capacities of each become static and stunted without their counterpart.

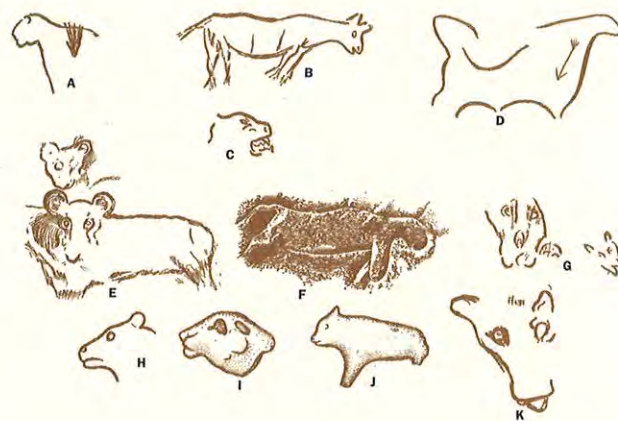
Let us acknowledge that most of one's day is made up of a collection of more or less elaborately artful activities,



A, Scantily clad woman apparently dancing, Geldorp, Neth. Note design of G-string and bracelets. B, Reconstruction. Dancing, like other arts, is universal, but as with drawing the practice and expression of dancing vary considerably between cultures and individuals.

often with scant direct or obviously productive components. For example, a strictly adequate meal might consist of nutritionally well-balanced, bite-size pellets of lab chow. But we don't stoop to that even when mountain climbing or in jails. Likewise, we don't all dress in a utilitarian norm but spend time tweaking our appearance for a blend that suits our sense of fashion, function, and fun—Mao's experiment in uni-dress failed for ethological reasons as much as for political ones. We are entertained by music, TV, reading, or games. We spend time decorating and maintaining our shelters and yards, even our offices at work. Expensively designed and marketed autos, computers, and other goods compete on many levels, and strict utilitarian function is a chimera. The examples can go on and on; in little or big ways, we play throughout much of our day. Art-making awareness and creativity can and do arise at any moment in this play—they are the next-of-kin—but it is the difference between art making and play that I want to emphasize here, and it is from their different evolutions that we can best see this.

Play is a biological emotional state separate from old utilitarian functions linked to our deeper evolutionary past. It is important to think in terms of play's several inter-related modular states. Play in species like ravens, turtles, and chimps can be informative about these modular states. If art making did evolve, its initial variants had to develop from somewhere. Perhaps when it comes to uniquely human capacities we may profit from taking a moment to see



I have made the point many times already that much of Paleolithic art was done by people at an early stage in their artistic development, the very time when play dominates waking life. Here are a few lion images to keep reminding us of that point: A, Gönnersdorf, Ger. B, Bruniquel, Fr. C, Labastide, Fr. D, La Mouthe, Fr. E, Trois Frères, Fr. F, G, and K, Font de Gaume, Fr. H, La Marche, Fr. I–J, Dolni Věstonice, Czech.

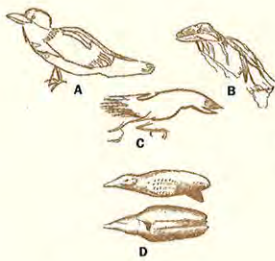


Play has considerable costs of risk, time, and energy. Foals frolicking are a metaphor for those costs, and so are things like humans drawing frolicking foals. A, Paleolithic frolicking, Altamira, Sp. B, A much later Bushman painting, Brandewyn River, R.S.A.

ourselves as an organism among other organisms. To do so here, we must start with play. Play is something we share with many other animal species, where it has the same origin and accomplishes similar functions.

### The Adaptive Nature of Play

Here in Alaska ravens are always at home. And during the cold months, particularly, they seem to witness everything. Their wings whoosh and hiss as they row through the heavy air, faces frosted with the moisture of their breath. Everywhere I go, there they are, wheeling, doing



Many corvids (ravens, jays, etc.) hang around human encampments and follow hunters to glean the scraps. They are facultatively versatile creatures. A–B, La Marche, Fr. c, Gönnersdorf, Ger. d, Mal'ta, Rus.

Other cultures sometimes chose corvids as the subjects of their images: raven or crow from later prehistoric Hopewell culture of the Mississippi Basin, done in native beaten copper with pearl eye.



rolls and loop-the-loops. They jabber with weird clicks, honks, and burrs. Unlike the tiny red poll finches, intent at my feeder, ravens do a lot of fooling around. They show up in odd places, doing odd things. By any definition, ravens play a lot, both socially and individually. They are even known to roll down snowbanks sideways or slide otter style. Their aerial acrobatics are magnificent. Ravens are a daily reminder that play is not a uniquely human enjoyment. But why ravens? Why don't red polls play too?

#### THE PARADOXICAL PRACTICALITY OF PLAY

The short answer is that playing is observed in animals whose niches require versatility. Versatile lifeways seem to require a mode of learning that allows individuals to build on a genetically given behavioral base. The raven's genetic program itself has to do with refinement, flexibility, and opportunism. A red poll, on the other hand, keeps closer to a strict agenda. Bent on one main pursuit, it must find and eat birch seeds that have dropped in the snow, scrapping with competitors for this bounty and stuffing its crop for the cold night ahead. A raven's day is not so closely defined. Most primates, likewise, have a rather open-ended day. Ravens are to other birds what primates are to other mammals.

Primates simply play more than other mammals, and they excel in the business of versatility. Among primates, we humans are the big players. We are an opportunistic,

innovative, and improvising organism par excellence. I have already spelled out my argument that the many interconnected traits surrounding that intelligence came from a unique style of large-mammal hunting. As I see it, we evolved as organisms that solved some highly rewarding problems *creatively*. Somewhat fortuitously, key human capacities that originated in solving Paleolithic-style savanna challenges were later applicable in other contexts. Our evolutionary line was progressively founded in situations characterized by change; that is, it was repeatedly subjected to novel problems requiring enterprising accommodation. Our evolutionary uniqueness is thus intimately linked to our biological potential to exploit unprecedented, newly minted opportunities.

But how does a species become biologically adapted to new horizons? What is biological flexibility of this sort? Adaptive processes are always a posteriori: present life is the legacy of what has worked in the past. There was—there is—no ready-made evolutionary module that creates a flexible and opportunistic animal. The roundabout adaptive solution was the modeling of some behaviors that indirectly facilitated mental and physical ability for sophisticated learning. The caveat was that the learning must be renewed every generation. The biological signature of this sort of program for individual education is *play*. Remember, this is characteristic of the Consigliere's indirect style: one doesn't eat to stay healthy but because food tastes so good; one copulates out of lust, not because one is dutifully following a set reproductive regimen. We learn and innovate best when we experience the added zest of delight, not from grim punch-the-time-clock determination. This may seem rather obvious, but a quick look around at the earth's other animal species will show how comparatively rare play is.

#### A PLAYLESS LIFE IS THE ANIMAL NORM

Most species do not play. No invertebrate plays, not bees, ants, scarab beetles, or mosquitoes—insects do not play.



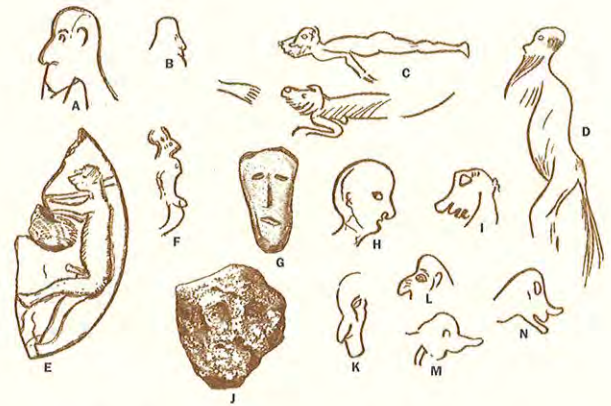
Indeed, even relatively few vertebrates play. One might expect it of some fish; they are so diverse in almost every way that one might imagine that some ethologist would have discovered at least one fish species that exhibits play, but not so far. Nor do any amphibians play. And only a few unusual reptiles do so. Turtles, the most intelligent, slowest-maturing, and longest-lived reptiles, are known to play on occasion (Burghardt 1998).

The pattern is similar among birds. Very few species play, and, again, it is mainly the most opportunistic, the most facultative, and longest-lived birds—the parrots and corvids. Ravens are one of the corvids, along with crows, jays, magpies, and jackdaws. The raven niche in the north is remarkably enterprising. In the wild, ravens specialize in searching for large-mammal carcasses to scavenge or in following animals like wolves to feed off their leavings and feces. Traditionally, ravens often followed human hunters for the same reason. Today, ravens rely mainly on human camps, villages, and towns, an association I suspect is quite old. Corvids must have been the main camp followers in the Paleolithic. And in addition to pilferage and scavenging, ravens are fair predators of small game when given an opportunity.

#### FOOLING AROUND FOR FUN AND PROFIT

In contrast to the above groups, mammals are exceptional because all mammalian species play, though most mammals play only when young. Carnivores and primates exhibit the most play. And, notably, play is most highly correlated with opportunistic, facultative flexibility, and only secondarily with sociality. For example, bears and most mustelids, like mink and otter, are very playful, but they are not very social outside the nuclear family. The most elaborate play, however, seems to occur among social species.

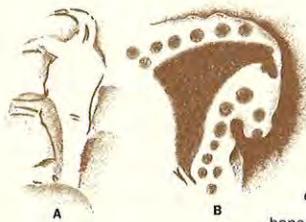
Our nearest relatives, the chimps, are great players, but nothing like humans. Humans are distinguished both by an incredibly long and playful childhood and by the continued presence of play in adults. In fact, it is possible that



Were these rather elementary Paleolithic images done by people who were just fooling around? How can we account for so much playing in human behavior? A and L, Marsoulas, Fr. B, La Colombière, Fr. C, La Madeleine, Fr. D, Lourdes, Fr. E, Mas d'Azil, Fr. F, Pileta, Sp. G, Dolni Věstonice, Czech. H, Saint-Cirq, Fr. I, Gare de Couze, Fr. J, Romanelli, It. K, Font de Gaume, Fr. M, Isturitz, Fr. N, Rouffignac, Fr.

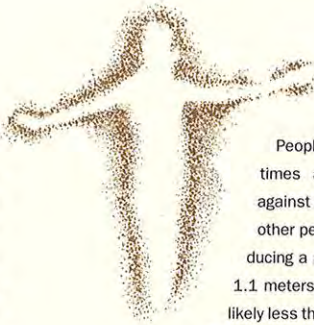
adult play is central to the adaptations of our species. It may be very literally true, not that adult humans play because we are young at heart, but rather that we remain young at heart because we must play. Our long developmental time seems to be tailored to foster the exercise of trial-and-error learning through imagination, driven by self-rewarding delight and interest—in short, fun, all the behaviors that we can best collect under the word “play.” Many years ago Huizinga (1938) wanted to call us *Homo ludens*, the playful ape.

In sum, the ethological evidence suggests that the fun of play was the evolutionary answer to developing an animal that is intelligently flexible and opportunistically able. Play works this effect with limbic incentives, that is, enjoyments and pleasures. Playful species enjoy self-rewarding aspects of targeted kinds of play, because these potential enjoyments of playing entice and encourage an animal to do something, to be curious, to fool around. Of course, this kind of acquisition, trying out new moves and responses, involves making mistakes. Play is designed by evolution to diminish the effects of those mistakes. But not only does play exercise versatility, it also seems to in-



horse was standing on end as in A, Pergouset, Fr., or when shadows allowed one to make a horse image within a natural horse image as in B, Pech-Merle, Fr.

What does one call it when someone going through a cave sees horses in the shadows and uses ochre or a sharp stone to make them even more horse-like? Whatever one calls it, it looks like fun, perhaps even more so when the suggested



People from every culture play. In more recent times an Australian child stood straight up against a stone wall, arms outstretched, and another person spit ochre around the periphery, producing a prehistoric full-body print. The child stood 1.1 meters tall, so we can say he or she was most likely less than ten years of age. Eastern Bigge Range, Queensland.

herently *activate* experimentation. Play contains the seed, as it were, of flexibility and experimentation.

Ethologists discern behavioral modules, or clusters, of play activities. These are genetically tailored to the adaptive demands of each species, as in climbing play among goats and in biting play among carnivores. However, it is interesting that most kinds of play secondarily involve the whole brain, and certain play apparently integrates parts of the brain that are otherwise used for different specialties (Brown 1998).

Though play may have seemed to a Victorian Darwin as merely biological waste, we understand now that it is an essential and adaptive biological route to enhanced biological capacity. Play is keenly practical, but in a very roundabout way. The remarkable, two-decades-long dependency of human offspring is not meant to be spent in waiting for adulthood or in boring drill. Play may be “fooling around,” but fooling around counts. Most juvenile learning and probably the best of our adult learning come from playful effort. Play is the writer, producer, choreographer, director, and actor of learning. The metaphorical cast, of course, are one’s playmates, hence this book’s dedication. And, just to reassure you, I am not wandering off from the pursuit of Paleolithic art; we are still on track.

We are evolutionarily tuned to learn best through playful activities that provide internally driven, self-rewarding fun. Games and play shape hand-eye coordination, nimble feet, endurance, strength, memory, word skills, reasoning ability, and other skills that activate and cultivate a sharper adult edge. Dolls and other toys let children re-

create social and familial roles, to be explored later as adults. Rough-and-tumble play, wrestling, and tickling are more than calisthenics for adult fights. Among mammals sexual play is very important—young animals tease, feel, sniff, and mount, irrespective of gender. Group sports hone cooperative and physical skills for life’s real contact sports. Selective forces shape deep patterns in human play, including social/team play, just as they do sparring play among bucks and fauns (Miller and Beyers 1998).

#### THE COSTS OF PLAY

I would like to have you understand the biological significance of play in a bit more detail before we return to our theme of art making. Play is so “natural” to us, so much a part of our way of life, and particularly our children’s lives, that the challenge here is bringing it up to the forefront of our focus for some serious attention. Let’s do that for a moment by examining some of the costs of play.

I was observing a ewe band of Dall sheep through binoculars in midsummer once and saw two lambs chasing back and forth across a precipitous rimrock above me. I was thinking what a beautiful lesson this was of how they come to be such agile adults. Then, my throat caught as one slipped and fell to its death. Not only does mammalian play require energy costs of some 4–10% of calories consumed (Martin and Bateson 1984), but many kinds of play also carry the risk of injury or even death (see a more complete review in Beyers 1998). For example, Harcourt (1991) found severe mortality costs associated with



Some young animals die in play accidents, and others use up precious energy that might have sustained them over difficult episodes. Two images from Paleolithic art that appear to be of young mammals:  
 A, Arudy, Fr. B, Mas d'Azil, Fr.

play among South American fur seals, which were much more likely to be eaten by other seals when they were playing away from their mothers. Beyers (1977) found that ibex kids frequently had play injuries. Caro (1987) noted the indirect costs of play to cheetahs, as playing cubs reduced maternal hunting success. Such costs of play are noted in study after study of play in mammalian species. The persistence of play in the face of such strong selection pressure against it is itself a robust argument that play provides positive fitness advantages.

Consigniere solutions are often sloppy and approximate but they can never be far off target for too long. Natural selection would not have turned such a blind eye, tolerating this degree of waste. So it is legitimate to look for biological paybacks for play, understanding these may not be immediately apparent in the short term or even in every individual's lifetime.

In a broader sense, behavioral mistakes among adults are likely to diminish fitness; thus, selection favors adults who get something right on the first go (Frank and Frank 1987). Of course, adult mastery is one of the benefits of certain kinds of juvenile play. The developmental time and energy costs associated with play are so inordinately great that play would have been selected against were it not offset by substantial benefits. There is no other explanation of play behavior that is a credible contender to the hypothesis that play allows accumulation of developmental skills to cope with a more unpredictable adult future (Ewer 1968; Symons 1978). Earthworms and fruit flies mature quickly and never pause to play. But being a mammal means very high costs devoted to rearing each young, and we furry creatures must afford the expense of play to de-

velop individual adult facility and capacity, thus the prodigious extravagance of human childhood.

Like the Paleolithic youths who climbed back into the dark caves, our early ancestors were, evolutionarily, given the time to play. Almost twenty years of support are demanded of human parents, and this is only part of the cost because childhood is demanding on the young themselves. During that time, in most subsistence societies, over half of the children die from mishap or disease. Baboons, in contrast, raise their young to maturity quickly, and their young are grandparents by the time we are teenagers. Natural selection strongly favors baboon-style rapid turnover unless there are considerable extenuating benefits. Our line paid—and pays—the price of the extravagantly long human childhood because all that play-time returns dividends applicable to our niche—in fact, they are requisite for our niche. My aim is that you value these evolutionary dividends—our human capacities—all the more by understanding just how dear is their biological price.

#### THE GENETIC COMPONENT OF THE PROPENSITY TO PLAY

This evolutionary tack of more learning gained through a long childhood was a difficult route because it involved acquiring facility and wisdom through many mistakes—and mistakes can be costly. The partial evolutionary fix for this was to create a sort of virtual world, paralleling the adult world, a vital playground of make-believe, where the penalties of failure were reduced, and yet successes were still rewarded. But how to develop this play behavior? As with most evolved traits, when it comes to propensity to play, all are not created equal.

As we have noted, mammalian species vary in amount and kinds of play, and these different propensities seem to be genetically specified. Furthermore, within any one species, all individuals do not play alike; some play more, others less. If we were to take one population and artificially

young animals die in play accidents, and others  
 up precious energy that might have sustained  
 n over difficult episodes. Two images from Paleo-  
 thic art that appear to be of young mammals:  
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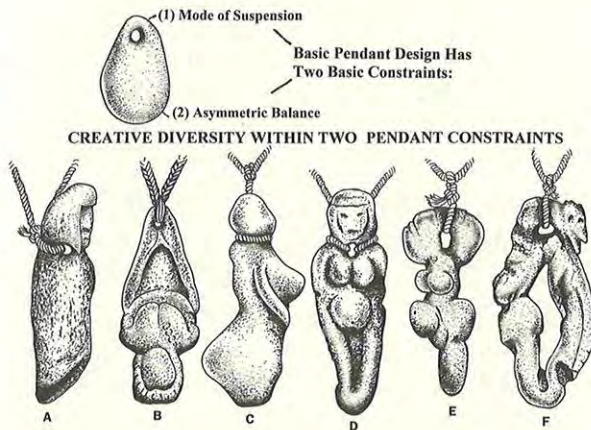
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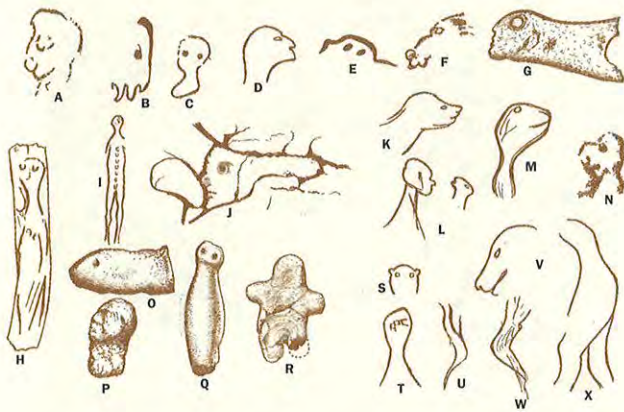
How to hang a pendant? Pendants consist of a mounting fixture and an asymmetric weight, as seen in this simple Paleolithic ivory pendant (above) from Geissenklösterle, Ger. But beyond this there are numerous design options (note suspension): A, Bédouillac, Fr. B, Mal'ta, Rus. C-F, Balzi Rossi, It. (called "Innominate, Janus, Bicephalous, and Doublet").

Thus, while we don't know the heritability fraction for play behavior, we can see that selection has created a genetic response in a number of different lines of our domestic pets—and in our line as well. All this is strong suggestive evidence that the heritable fraction of play is significant among mammals, including us.

### Social Invitations to Play

One characteristic shared by many kinds of play is a certain loose elasticity, even though play occurs in particular modes. In social play this elasticity is often paired with and preceded by a very specific gesture that signals "come play." In contrast to the play itself, these play signifiers or invitation gestures are quite stereotyped. It is as if these gestures not only signal "come play" but perhaps more properly "everything from here on is not for real, it is just for fun." Forms of play solicitation differ among species, but there is some cross-species continuity, especially among primates. Who could fail to recognize the monkey signals of a hidden peek (it will make a human baby smile

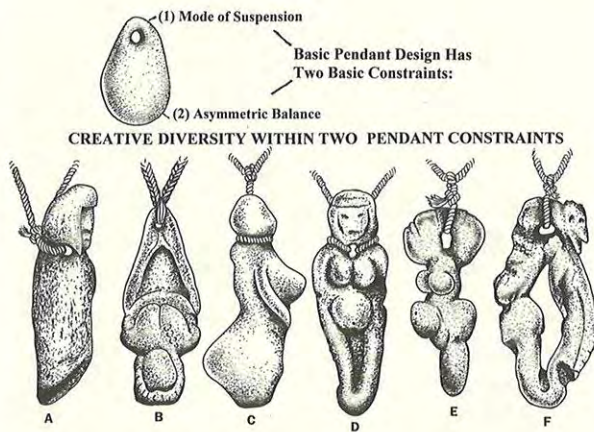
THE EVOLUTION OF ART IN THE PALEOLITHIC 381



I need to reiterate and reiterate this theme: there are many rather crude attempts at people's faces and bodies done by Paleolithic folks who were just getting started in the arc of art development. A, Rouffignac, Fr. B–C, Font de Gaume, Fr. D, Los Hornos de la Peña, Sp. E, Lascaux, Fr. F, Villars, Fr. G, Roc-de-Marchamps, Fr. H, Laugerie-Basse, Fr. I, Bruniquel, Fr. J, Mas d'Azil, Fr. K and P, La Madeleine, Fr. L and T, Les Combarelles, Fr. M, Los Casares, Sp. N, Fontanet, Fr. O, Meersburg, Ger. Q, Dolni Věstonice, Czech. R, Maininskaya, Rus. S, Trois Frères, Fr. U, Niaux, Fr. V, Commarque, Fr. W, Courbet, Fr. X, Lourdes, Fr.

select for the propensity to play, would there be a genetic response? Remember, one of the best ways to estimate heritability is from *selection response* (Alcock 1993), and here the outcome of domestications can be informative. Domestic animals, both pets and livestock, have undergone intentional selection (and perhaps inadvertent selection as well) for individuals that were more affectionate, tractable, and playful than ones we chose to cull (Morris 1986; Thomas 1993).

Wolf pups play during most of their nonsleeping hours, but as they grow older the amount of play decreases to where there is very little play among adults. But domestic wolves (dogs) are very different. Individual adult dogs of most breeds would be content to play all the time, even into old age. We train them via play by making games out of retrieving, search-and-rescue trials, herding, etc. Indeed, the zest that cats and dogs exhibit in their play is one of the most rewarding things about having them as pets. And it is their playfulness as well as affection that makes pets a bit like having children (Morris 1986).



How to hang a pendant? Pendants consist of a mounting fixture and an asymmetric weight, as seen in this simple Paleolithic ivory pendant (above) from Geissenklösterle, Ger. But beyond this there are numerous design options (note suspension): A, Bédailhac, Fr. B, Mal'ta, Rus. C–F, Balzi Rossi, It. (called "Innominate, Janus, Bicephalous, and Doublet").

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**The Selective Advantages of Play:  
A Play-Fighting Example**

*Practice in the performance of any task will decrease the number of neural networks necessary to perform it.*

M. I. Posner and M. E. Raichel, *Images of Mind*

Let me give you some concrete data on the importance of play by looking at a specific example. In arguing for play as practice for adulthood, Symons (1978) proposes that it is not fortuitous that young male primates play fight more than young females and that fighting success matters most among mature males. The first serious, potentially deadly, fights among adult male primates come after thousands of juvenile play fights, done with exuberant fun. By the time these serious fights occur, males are well educated in fighting techniques. Statistically, successful male fighters impregnate many more females than unsuccessful ones. Loy (1970) and Koford (1963) found that higher-ranking rhesus males mated almost solely with mature fertile females. This attraction of dominant males to prime females was positively related to fecundity. Those females had a higher percentage of effective copulations (45.2% vs. 6.8%), a much greater likelihood of giving birth (0.729% vs. 0.136%),



Given the opportunity, young pups romp and wrestle for hours on end.

and a higher probability of infant survival (0.62% vs. 0.50%) than less fecund females. Selection pressures go beyond simple differences in the above statistics. Most mortality among male rhesus monkeys seems to be due to male-male aggression. Many males show serious slash wounds from canines. At age eight only 26% of rhesus males were still alive, whereas 60% of the females were. Likewise, most mortality among all groups of gorillas and chimps seems to be from intraspecific fighting.

Rough-and-tumble play goes on among young primate males for many hours a day, enjoyed all through their youth. This play consumes large quantities of time and energy and may superficially appear to have no immediate function, but one can easily imagine the selective forces behind such play fighting.

more than any other gesture!) or the play face made toward babies, with wide eyes and a tight O mouth? Locomotor intention movements are also important play releasers; the gamboling, galumphing gait, tagging, waving arms, and rolling over on the back invite wrestling. Many species use an open-mouthed play bite, a special controlled nibble.

Canids use specific behaviors to delineate social acts of play from serious reality. Darwin described the play bow, a shoulders-down, rump-up display among dogs, which both invites and demarks play. One might imagine it as built on a mixed metaphor, combining gestures of erect aggression and supine submission. Bekoff (1974) described

a high leap and face-oriented pawing as another play marker for canids. Lions use a play bow similar to that of canids (Schaller 1972). There are many other forms of mammalian play invitation: a mongoose whips its tail, voles and field mice use a play pheromone, bears wobble their heads, and polecats have stiff-legged jumps (Wilson and Kleiman 1974; Morris 1990). The primate play invitation employs an open-mouth display with the face relaxed and the lip covering the upper teeth. Again, this signal combines mixed-metaphor elements characteristic of aggressive and submissive signals.

What are our own play-signifying behaviors? We mainly smile and laugh. These gestural metaphors com-

Bushman painting of two sparring young antelope playing at fighting. Most preserved Bushman art is later than Paleolithic, but it contains some similar features of subject choice and rendition. Worcester District, R.S.A.



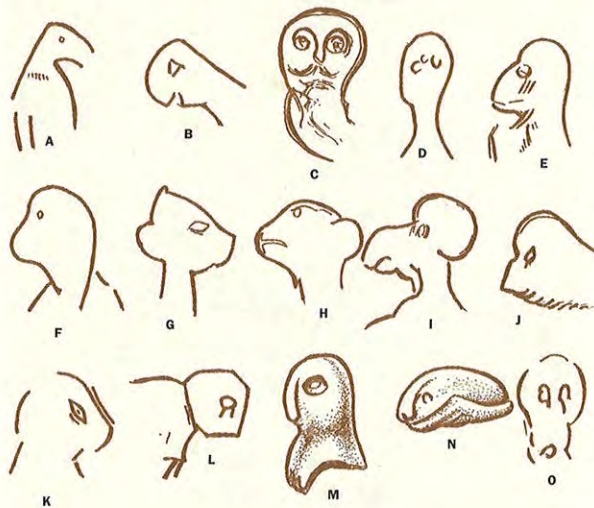
A bronze pup in play-invitation posture. The sculptor used this familiar gesture to decorate a fountain in a public park.

bine elements of aggressive and submissive signals. Primates and other animals that use teeth to bite their opponents have a reflexive aggressive gesture of a snarl, in which the top lip is lifted to expose the canines. We have the opposite metaphoric gesture for submission—pulling the mouth corners back to reveal the molars in a grimace, while hiding the canines. Just try it. Our play invitation gesture is a mixed metaphor of anger and grimace, a loose-lipped show of teeth, both the molars *and* the front teeth. It is our smile.

Active play among children is normally done from a high-arousal state. Apparently, this high arousal activates brain areas that facilitate learning. High arousal is also usually accompanied by heavy breathing or panting. Indeed, most primates include heavy panting, a metaphor of “vigorous play to come,” as a play releaser. Chimps use the old primate open-mouthed inhalation-exhalation cycle, ha-huh-ha-huh (Aldis 1975). Humans use a derivation of this panting cycle, by deleting the inhalation portion and keeping only the repeated exhalations, ha-ha-ha-ha, of laughter (Guthrie 1976). Laughing and play go together. Children laugh more than adults, probably because they play more. Laughing kids are healthy kids; the cacophony



A Paleolithic smile? Rouffignac, Fr.



Paleolithic faces made by those not far along in their drawing development: A–B and O, Marsoulas, Fr. C, La Marche, Fr. D–J, Les Combarelles, Fr. K, Los Casares, Sp. L, Gabillou, Fr. M–N, Roc-de-Marcamps, Fr.

from school yards is dominated by laughter. Laughter is our main social signifier of the fun of play. At least one Paleolithic image shows a smile. And there are many that should elicit our smiles, if not laughs.

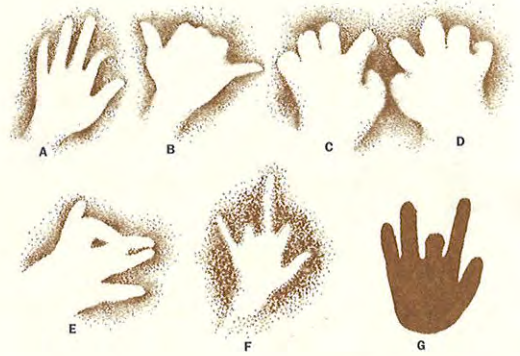
### The Nature of Play

Behaviors can have specific smells: a smell for love, another odor for follow me, go where I have been, a smell for fight or panic, and so on. What is it like to communicate with smell? Consider the steamy traffic in an anthill or termite mound. Here, thousands of individuals in a giant family carry out intricate duties with great industry but with no leisure, no fantasy life, no holidays, and no jokes.

**Play Addiction** Like most other vertebrates we have a pleasure center in our brains. Fun is the emotional experience when that center is activated by certain kinds of neural activity. The chemical at the center of this activation is the neurotransmitter dopamine, which can act as an addictive substance promoting learning. Some forms of addictions are adaptive. Kids go back again and again for things like carnival rides and often play at a favorite game over and over, beyond the point of parental patience. Insatiability is a frequent feature of play, providing such a charge that one does not want to give it up, cannot put it down, cannot stop. We should note that young people often become playfully addicted to aspects of art making as well. They can enjoy the same song over and over, redraw a favorite image with the subtlest of variations, or perform a favorite dance, read a favorite book, or watch the same video again and again. All the while parents must remind themselves: "It is normal for my child to do this. It is normal for my child to do this. It is . . ." What does this have to say about the taphonomy of art? It says that kids tend to produce their art in a continuous stream, and because of this, kids tend to do more art making than adults. And we should be alert to these patterns when we look back into the Paleolithic.



Play addiction. Parents did not have to force Bushmen adults to play at shooting or dancing. Late Holocene painting, Epiphany Mine, Victoria, Australia.

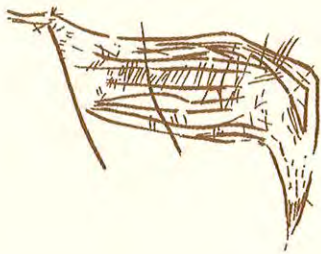


Lamp shadow games using hand images are a common children's game. It is but a slight shift to make a silhouette in ochre. A–B, Black Palace, Queensland, Austral. C–E, Aztec, Yucatan. F, Baracoo River, Queensland, Austral. G, Canyon de Chelly, New Mexico, U.S.A. (probably the hand was traced and then the interior painted), similar to Pleistocene hand prints.

Yet they are successful beyond our imagination—these groups have dominated the earth's landscape for the last half a billion years. By weight they exceed us and our livestock. In fact, there are many more of these social insects than all vertebrates put together, may always have been, and perhaps always will be. Such lives, fully orchestrated by genetic prescription, are not passé; they are, quantitatively, the mainstream. And we should give due regard to their pheromonal perfections. Compared to them, we long-lived players operate at the margin of earth history, but the evolution of our costly flexibility out on the periphery involves other fascinating adaptations.

Let me review the argument that play, and art as a special kind of play, are adaptive. Recall that there are some basic criteria traditionally used to evaluate whether or not characters are biologically adaptive. In this instance the list might read as follows: (1) There are causal linkages between facultative ability and play, and the peculiarly human extension of play, art making, is linked with creativity. These connections are, in short, not mere behavioral epiphenomena. Rather, (2) play and art are improbably complex and coherent sets of behaviors. (3) Empirical evidence substantiates the logic that they result in reproductive fitness advantages, which (4) override significant evolutionary costs in time, risk, and energetics. (5) Their





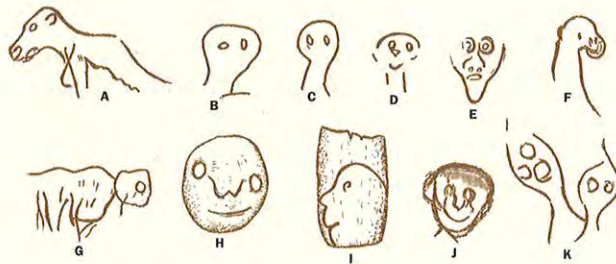
Parpalló, Sp.

individual and group variations have a genetic component. (6) Play forms part of an evolutionary gradient and pattern among related organisms. (7) Play and art are universally distributed among all human groups. (8) In a larger way, this theory has broad explanatory powers superior to those of competing theories. If these propositions are credible, they can provide a unique context for viewing Pleistocene art and can help us understand the place of art and play in our lives.

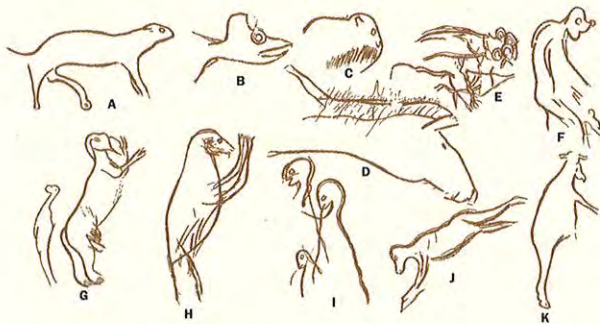
My attachment of the evolution of play to behavioral flexibility is not new. A century ago, Groos (1901) proposed that play was an innate mechanism which directed adult development. Many ethologists and psychologists (e.g., Piaget 1964; Alland 1977) have clearly articulated connections between flexible behavior and play. I simply want to pull this thread out a bit farther and more explicitly link our remarkable art-making and art-enjoying abilities to those evolutionary roots. But before we go any further, I want to say that one problem in studying play and art making is that so many forms of these activities are not directly observable.

#### IMAGINATION: THE BIGGEST PLAYGROUND OF ALL?

Much of human play, perhaps even most, remains unseen. I mean, of course, the play of imagination, daydreaming, or fantasy. This fantasy does sometimes leave traces. Is that what we see in Paleolithic art? I think so. It had to be the nucleus that generated most of Paleolithic art, as indeed it must underlie most art. That is why their art allows us a glimpse into their fancy, their imagination itself. Like them, we live amid relentless internal fantasy, not the TV



More examples to illustrate the childlike character of the artists responsible for much of Paleolithic art: A and J, Les Combarelles, Fr. B-D, Marsoulas, Fr. E, Labastide, Fr. F, Le Portel, Fr. G, Gabillou, Fr. H-I, Laugerie-Basse, Fr. K, Gönnersdorf, Ger.



Another sampler of the abundant drawings from early stages in art development: A, Mas d'Azil, Fr. B, Gönnersdorf, Ger. C, Gargas, Fr. D, Parpalló, Sp. E, Pair-non-Pair, Fr. F, Isturitz, Fr. G-H, Altamira, Sp. I-K, Los Casares, Sp.

show or mystery novel kind with rational flow but our own storytelling, story-making, disjointed commentary. Our brains are seldom still. They nimbly roll out the most pedestrian or Walter Mitty scenarios and run situation replays of what was, or should have been, said or done. We have considerable conscious control over these fantasies, retailoring and rewriting them to be more interesting, but they often take the bit and chase themes of their own making. This must be why so often when we talk with another person we are only half-listening. The rest of our attention is catching snippets at the cinema of the mind. We are, in essence, more playful than we think. The perspective of natural history reveals us as profoundly creative animals.

It is straightforward to propose that daydream fantasies evolved as calisthenics for creative thought, internally

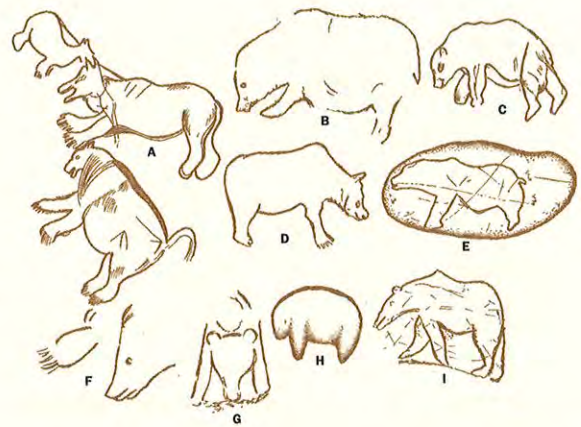
driven enjoyable play, a theater that keeps us in shape to function well in our unpredictable life as a truly facultative organism. We don't have to work at fantasizing; it is difficult to turn off. Fantasy seems to be important for our biological upkeep, like circulating blood or bone calcium turnover. This perpetual theater gives us a lot more experience and allows us to create ever newer and more elaborate stories than we could ever get in our "for-the-record" portions of the brain. These fantasies contribute to the brain's high metabolic rate, about 20% of our daily energy budget. When we stop fantasizing (as during successful meditation), our pulse rate and blood pressure drop noticeably, another reminder of the expensiveness of play.

Fantasy tends to throw a wrench into simple psychological studies that would associate play and creativity. Theoretically, we could test the association of art and creativity by examining the results of play deprivation—are people who live without play very uncreative? And we could ask whether artists are much more creative than nonartists. The answer to these questions from several studies seems to be yes (Brown 1998), but the problem is how to measure even less accessible dimensions of art or creativity, such as night dreams.

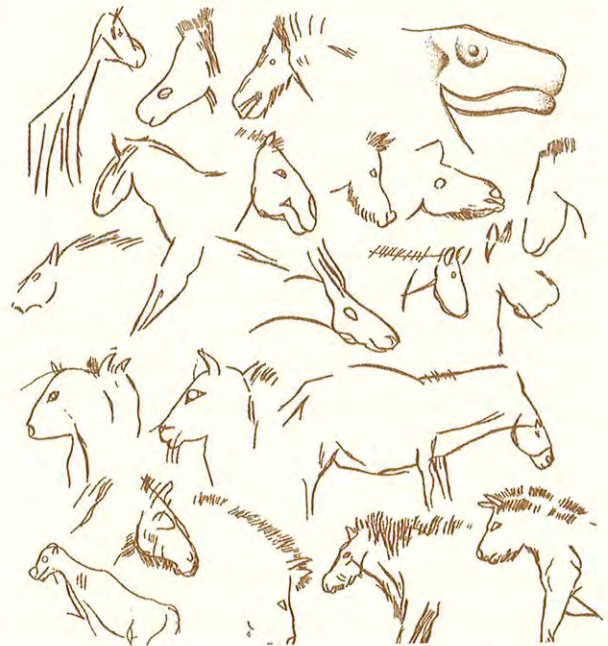
#### PLAYING, ON AUTOMATIC

As it was with art, for most of the twentieth century science was utterly lacking in insight into sleep and dreams, dismissing sleep as an epiphenomenon or mere by-product. Experiments in the past decades have shown that dream sleep has important functions for health and well-being. We live in the theater of the mind all night (well not exactly all night—we take intermissions); during bouts of "rapid-eye-movement" (REM) sleep we run through the equivalent of a condensed week of surrealistic TV soap operas. As a daytime-adapted primate we have an average of 12 hours of downtime after dark. Why not put it to use?

We do. Researchers argue that dreams lubricate our learning processes and are critical for healthy mental



A collage of bears in Paleolithic art found at different sites. Note the varying levels of drawing development. A, Trois Frères, Fr. B, Venta de la Perra, Sp. C, Les Combarelles, Fr. D, La Colombière, Fr. E, Gazel, Fr. F, Lascaux, Fr. G, Massat, Fr. H, Dolní Věstonice, Czech. I, Laugerie-Basse, Fr.



Horses from one Paleolithic site, Les Combarelles, Fr. Most seem to have been done quickly in passing by people of an age-group who were not experienced drawers.

function. It is probably no coincidence that the animals most familiar to us, dogs and cats, who also depend on opportunistic learning, obviously have vivid dreams. Anyone who has lived around dogs or cats is familiar with their eye twitches, little whimpers and growls, and leg motions of running, all while they are asleep. Carnivores are opportunistic mammals that demand a lot of daytime play in their development. They go to night school as well, and this expends more energy than nondreaming sleep, at approximately the same rate as waking periods. Of course, young animals have much more REM sleep, and hence more dreams.

### Youthfulness and Playfulness

The lens of natural history throws a spotlight on the uniquely prolonged human childhood and on the neotenic extension of childlike elements into later, adult phases of life. A big part of that extension concerns play, and the specialized kind of play we call art. One seldom plays or makes art without expending time and energy, and the greatest free time and most abundant energy are always found among the young. Indeed, this is when most art is made now, and this was likely so in the Paleolithic as well. And little parental inducement is needed. Like all other forms of play, art is self-driven, self-rewarding. The natural history of youth and play thus becomes more important to our understanding of Paleolithic art because young people likely accounted for more of the preserved art than we usually imagine.

#### PLAY AND ITS CRITICAL PERIODS

One thing that strikes people who study animal behavior is the importance of developmental timing. Neural pathways in young animals have critical periods of maturity that correspond to the activities characteristic of a particular phase of development. Socialization, compass orien-



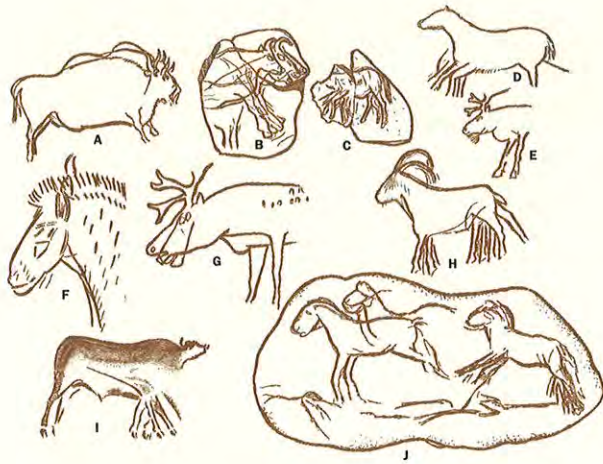
A Pleistocene bison calf apparently playing with its mother. Most play occurs among the young. Adult females usually play more than adult males, and you can see why by looking at this drawing—you have to have a sense of humor to raise kids. Which is to say that playing is crucial to development, and mothers often encourage it by being players themselves. Brassempouy, Fr.



A young artist from La Marche, Fr.?

tation, bird song, language, and many other features are formed during sensitive periods in a young animal's life. If not properly activated during that window, expected behaviors often do not develop in a typical fashion. Physical growth, the connection of neurons, synapse formation and elimination—in short, numerous aspects of brain development—are exquisitely time sensitive.

Among animals, play also seems to have just such distinct developmental periods, and some have been mapped (e.g., see Beyers 1998 for a review). Generally, mammalian play peaks in youth; however, newborns play little—at that age survival is tenuous, and meeting necessities seems to have been the main competitive focus of natural selection among newborns. Competition within the litter is most lethal at this point—for example, among owl nestlings and among fox and hyena littermates. That changes with time and play begins to increase. In a related way, a human infant's energies are focused on growth and nourishment in the first few months, and human mortality at that time is at its highest. Once past six to nine months, survival becomes more assured, and play continues to rise after that. For example, children peak in rough-and-tumble play between five and ten years of age (Ornitz



Trial and error. Though drawing involves getting down something that is on one's mind, often our drawings reveal that the details of our mental imagery are unclear. This look-draw cycle sharpens the mind's ability to see differently. Here are some redrawings from the Paleolithic . . . let's see, exactly how does this leg go? A, Teyjat, Fr. B, E, G, and J, Limeuil, Fr. C, Laugerie-Basse, Fr. D, Mas d'Azil, Fr. F, La Marche, Fr. H, La Colombière, Fr. I, Altamira, Sp.

1983). The percentage of the day devoted to other kinds of play continues to rise. Most forms of play generally decline on into adulthood.

It is obvious why play declines after adolescence among most mammals, especially among males. Serious things are at stake, and a frivolous miscommunication cannot be regularly risked. That is to say, the cost of that kind of play begins to outweigh its benefits. On the other hand, female mammals are more likely to play as adults, probably as part of caring for the playful young. For example, adult lion males virtually never play; whereas lionesses often do with cubs (Rudnai 1973). Humans, of course, continue playing into adulthood, but even there, many kinds of play characteristically peak during adolescence: competitive sports, exploration, adventure seeking, sexual fantasies, etc.

Csikszentmihalyi (1975) examined kinds of human play and how these changed with age: adventure-seeking, kinesthetic, object-fiddling, social, sex, creative-imaginative, and attentive play (people watching, watching TV, listening to radio). He found that all kinds of play

declined after adolescence except social play. Kinesthetic play decreased most—do you like to go on breathtaking carnival rides as much as when you were fifteen?

Such observations, remember, were important when we tried to determine who went back into caves; adventure play peaks between eleven and seventeen. Recall those numbers from chapter 3? Play in youth seems crucial for healthy adult development. Sometimes the negative side of this is quite apparent. Deprivation of locomotor play during critical periods seems to affect adult abilities across a wide front (Beyers 1998). Play deprivation and/or play abnormalities when young are often noted among adults incarcerated as criminals and among those who become violent adults, alcoholics, and injurious parents (Brown 1998). More important for our concerns here is that experiments have shown that play among schoolchildren influences their ability to innovate (e.g., Dansky 1982; Dansky and Silverman 1973).

#### EXPANSION OF CHILDHOOD, EXPANSION OF PARENTHOOD

The natural history of play and art adds yet another angle to our view of the evolution of human parenting. Of course, the other side of the evolutionary coin of an expanded human parenting is an expanded human childhood. I have emphasized that one of the chief trends in human evolution must have focused on parental protection and care—a high investment in each offspring over an extended period of their lives. This neotenic trend kept children from reproductive responsibilities longer and longer. As with some social carnivores (lions, hyenas, wild dogs, suricates, wolves, and jackals), older sibs stayed with the parents and helped with the younger children, and a cohesive band of these families was formed, glued with genetic cement. Looking at desert kit foxes playing among parents and sibs, the term “family” for these groups is not stretched too thin.

Of course, the extensions of childhood and parenting were back-to-back, evolutionarily linked dynamics. They

**Time and Play** I can testify that days were much longer in the 1950s than they are now. Play is probably related to our perception of time; perhaps this is why there is kids' time and adults' time. With an open sense of time, one can be indiscriminating in trying new things, but a constant stream of upcoming obligations inclines one to winnow out any "nonconstructive" activity. If your days-of-youth seemed to hit pockets of forever boredom, it was to allow you to play. And if time in adulthood seems to press, it is probably to motivate toward meeting serious needs. While the biological dimensions of our time sense have not been given due regard in technical literature, they are especially important in art and creativity. Perhaps that is why new ideas and insights come at such strange free moments: in the bath, walking home from work, or those last minutes at the office when you are too tired for more work—pockets of temporal freedom when we return to kids' time and are able to just fool around.

allowed more preparation for adult reproductive responsibilities and more time to absorb and retain vast quantities of information and hone problem-solving skills, especially aided by verbal communication. A complex language was undoubtedly the key catalyst in all this. Reproductive success increased with the direct help from older offspring, and parents added to their fitness by fledging increasingly quality-added young. Furthermore, human modes of play meant offspring became individuals with the plasticity to think for themselves, which was fostered by past success in decision making, which in turn was promoted by prolonged trial and error in the freedom of play.

#### LOVE AND PLAY

Pair-bonding, as well as parent-offspring bonds, probably feeds on this play process. There is something in the bonds between humans that is akin to play: smiles and giggles, expanded awareness, delight in one another, and the ability to enjoy imagining another's enjoyment—in short, the ability to love. The evolutionary extension of play into



Much of Paleolithic art at La Baume Latrone, Fr., has been described as modernistic Picassoesque greatness, but if similar images were found in any other place they would be called children's art. At La Baume Latrone dark terra rosa mud from the cave floor was picked up and smeared on the white limestone walls with fingers. Fortunately, we do not have to argue over the artists' identity because the mud smearers also pressed their whole hands against the walls, leaving positive prints. These clearly are handprints of adolescent boys.



Prehistoric target shooting, a form of Bushman archery play. Late Holocene, Epiphany Mission, R.S.A.

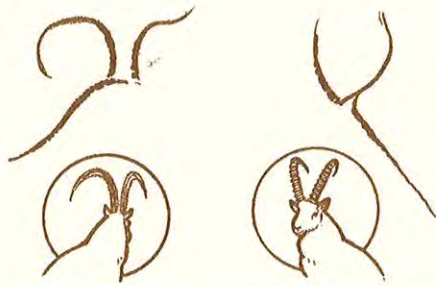
adulthood must have been linked to greater attachment and involvement of parents with children—simply delighting in playing with children and in child's play. We can see how that works in happy families today. And we can imagine that Pleistocene children who enjoyed a social context which featured bonded parents who were able to live among similar adults and children grew up to fledge offspring themselves who were better suited to the demands of the human niche. Indeed, it was a niche that required confident and creative intelligence and loving loyalty on the part of this increasingly novel animal, the human hunter.

#### Learning and Creating

The creation of something new is not accomplished by the intellect but by the play instinct acting from inner necessity. The creative mind plays with the objects it loves.

Carl Jung, quoted in E. Dissanayake, *Homo aestheticus*

Learning, or mastery of information, and creativity are related but different. We must remember to distinguish these related and easily confused siblings of mind. Teachers use methods that help students to learn certain material; teaching students to be more creative is a different

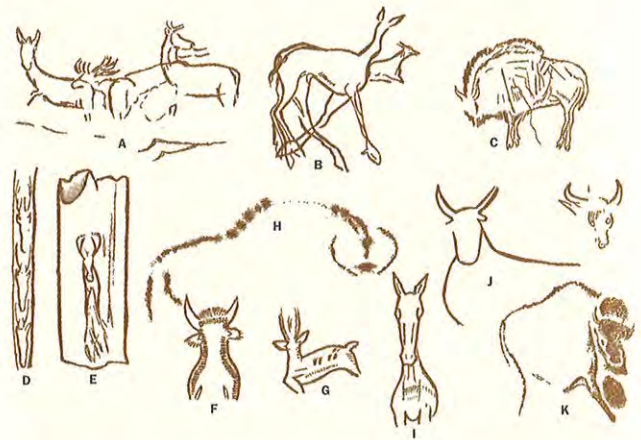


When an artist begins the risk of drawing, the results always fall short, to some degree, of the image he or she had in mind. The artists who made these two ibex from Niaux, Fr., experimented with some demanding perspectives. In the two circles are something like the perspective views I think they were trying for.

matter. Report cards record learning, as IQ tests reflect the ability to learn. Creativity, on the other hand, has an aspect that is strangely antilearning. Learning, more often than not, includes an acquiescence to past paradigms, which can sometimes get in the way of new visions. Among other animals that do play, this play is largely about tailored learning, not about creating. However, extremely playful species, those with strongly opportunistic adaptations, not only share an ease of learning but can be very imaginative as well. Indeed, this is why ravens and monkeys make terrible pets. They are too inquisitive for most households, and these capacities in our domestic settings translate into trouble.

Despite some overlap between learning and creativity, the two have different qualities. This duality is often hazy to educators and can be downright opaque to administrators and politicians. The qualities of intuitive play—its creativity and, at times, breath-catching new vision—are elusive and very difficult to talk about. They may be impossible to define and yet remain essential to scholarship, to art—indeed, to being human. Creativity may be something we must catch as shadows or reflections, like a floater in the vitreous humor, as its processes cannot be captured by a direct gaze. But we can often recognize its products, and that is certainly what we see in ocher and ivory shaped by Paleolithic hands.

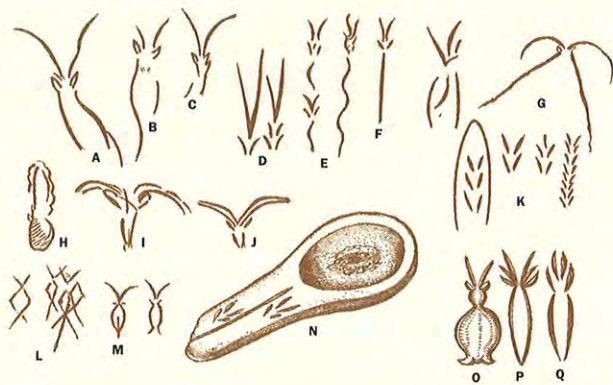
Generally speaking, learning has a different intensity from creativity. Most mammalian play, and its well-



Experimentation in Paleolithic art. Some unusual Paleolithic images of head positions: A, Limeuil, Fr. B, Mas d'Azil, Fr. C, Trois Frères, Fr. D–G, Gourdan, Fr. H, Marcenac, Fr. I, Caldas, Sp. J, Levanzo, It. K, Les Combarelles, Fr. L, Chauvet, Fr.

embedded learning, are often associated with such later, real-life, high-arousal activities as predation, flight, fight, copulation. During these high-arousal events it is very difficult to learn everything “on the job,” particularly on the first job—thus the importance of play rehearsals. Gold's (1987) research showed that memory, and hence learning, are greatly affected by high adrenaline levels. This means that exaggerated high-arousal play is a much more effective learning path than tenuous, nondirected activity. Arousal itself accelerates the learning processes. Exciting fantasy gets entangled with the kinds of art kids make, as part of enhancing their learning processes.

While high adrenaline may sear lessons home, creativity does not necessarily benefit from high adrenaline. Rather, perceptive breakthroughs seem to occur more often during quasi-meditative states associated with walking, relaxing, reading, and sometimes even sleeping. Art making seems associated with quasi-meditative brain-wave status. The heart of art making is particularly timeless. The combination of heightened awareness and full attention, this vivified state of being at creative play, is a fundamental part of the human character. Dissanayake (1992) has even proposed that we change the Latin name of humans to *Homo aestheticus*, the artful ape.

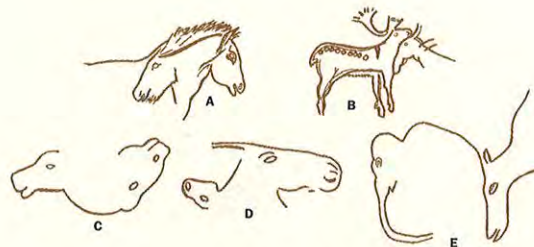


Some creative looseness can be seen in Paleolithic art that pertains to ibex. Those gigantic chevron-shaped horns almost begged to be integrated into abstract form. A, Otero, Sp. B and E, El Pendo, Sp. C, Urliaga, Sp. D, Cueto de la Mina, Sp. F, Paloma, Sp. G, Niaux, Fr. H and M, Raymondén, Fr. I, Montgaudier, Fr. J, Morin, Fr. K, Lascaux, Fr. L and O, Laugerie-Basse, Fr. N, Lamp, Lascaux, Fr. P-Q, La Madeleine, Fr.

### Now, Back to Art

This causal entanglement between art and play and creativity has been noted by ethologists and evolutionary biologists. For example, in his discussions of art as a kind of play, Fagen (1981, 1984) stressed the interrelations between behavioral plasticity and play, creativity and art. Olins (1992) pointed out that there is indication of play in Paleolithic art and emphasized the role of creativity in the play/art process. Here I make the additional proposal that natural selection for human creative plasticity was driven by our particular hunting-style lifeway.

This is not a mainstream idea. Though natural historians have seen that art could have evolutionary ties, there is disagreement as to how art and evolution are linked. Dissanayake (1992) reviews some of the ideas about the evolutionary role of art: to enhance communication (Alland 1977; Eibl-Eibesfeldt 1989a; Tiger and Fox 1971), as a means for individual display (Geist 1978; Harris 1989), to aid sexual selection (Low 2000), or to confer prestige (Harris 1989; Eibl-Eibesfeldt 1989a). Fagen (1981), as I said, proposes a direct link between art and creativity and, in a way, so does Dissanayake's idea (1992) about "making-



A single line playfully used as part of two images: A, Les Combarelles, Fr. B, Forêt, Fr. C, Gourdan, Fr. D, Laugerie-Basse, Fr. E, Gargas, Fr.

special" (see Bekoff and Beyers 1998 for critiques of these theories). My own view presented throughout this book is that play, art, and creativity are all linked to the process of our becoming large-mammal-hunting specialists. And, of course, in that context, childhood has a special importance.

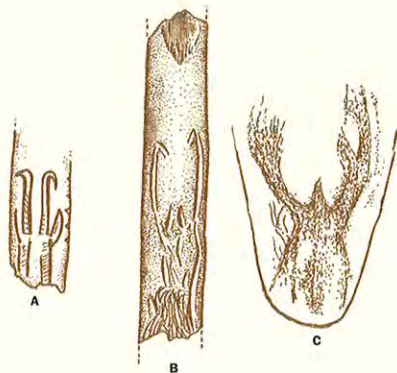
### THE ADAPTIVE ROLE OF ART: ARE ART ENERGIES SPENT PRODIGALLY?

For twenty-five hundred years of Western culture, the question, "What is art?" has been under constant consideration. Within the past two hundred years a major branch of philosophy has emerged, aesthetics, devoted solely to the attempt to answer that question. Few intellectual enterprises have so utterly failed; and to-day, it is seriously wondered if the question, "What is art?" can be regarded as a meaningful philosophical question at all.

M. Peckham, *Man's Rage for Chaos*

Throughout human evolution we retained most of our older primate play modules, but we evolved an additional kind of play. The whole lifeway of outwitting large mammals demanded not only that we be smarter but also that we be more imaginative, more creative. Creativity, the central part of humanness, is the activity in which we excel. But it does not emerge de novo: it has its special activator kind of play, a specialized kind of play module that more directly taught, and delighted in, true and beautiful innovation. What was that kind of play? It was art making. Art behavior evolved for creativity, the same way that lungs evolved for breathing.

Let me review an aspect of human origins as it relates to this topic. Before human ancestors began to play in this

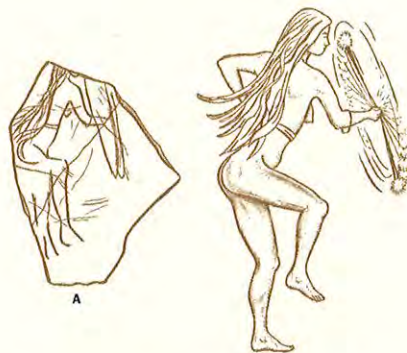


Creative foreshortening as viewed from behind: A, Chamois, Isturitz, Fr. B, Chamois, La Vache, Fr. C, Red deer, Mas d'Azil, Fr.

art module they must have been extremely committed players in the more conventional senses. From comparing our behavior today with that of other primates we can guess that early hominids played more than other apes when young but may not have brought much of that intensity of play to later life. Judging from complex anatomical evidence (brain development, the timing of tooth eruption, and body growth stages), researchers such as Bogen (1999) have documented the pattern of the lengthening childhood in early fossils of our genus (*Homo habilis* and early and late *Homo erectus*). I discussed possible reasons for that elsewhere, and will return to it later.

Whatever the reasons, this new species, *Homo sapiens*, apparently was subjected to greater biological demands on (or opportunities for) creativity than had existed prior to that time. But how could flexible opportunism be upgraded into genuine creativity? Apparently, the Consi-gliere could not find direct variations in some brain component for creativity. The problem had to be solved very indirectly. I think we can reconstruct the story of what happened. As it turned out, some play modules were already indirectly activating a facility for flexibility and exploration, and that was in the direction of creativity. So parts of these play modules were co-opted, reorganized, and retrofitted in the cause of pure creativity.

Apparently, the ability to obtain and communicate new insights demanded its own kind of virtual-reality module—a new kind of play, not like wrestling play, which developed various fighting abilities, and not like



A, Playing in the Paleolithic? Fadets, Fr. Although nudity in this engraving on a stone fragment may suggest an erotic intent, this is a girlish figure with leg raised, apparently dancing. Dancing is a kind of play. Time spent playing generally declines with age in all mammals. To a degree this applies to humans as well, but we are different from virtually all other mammals in that adult humans still spend considerable time playing.

object play, which helped us manipulate an array of tools. Rather, it was a kind of play that was specifically targeted and specifically dedicated to exploring and sharing new perceptions. For that, only the playfulness of art would suffice.

#### SELECTIVE ADVANTAGES OF ART BEHAVIOR

What does art do? . . . If the history of the human race is an epic of self preservation under adverse circumstances, of securing enough food to sustain our (and our children's) bodies, and of defending an area of land to live in, then how is it that all societies have been able to afford the luxury of art?

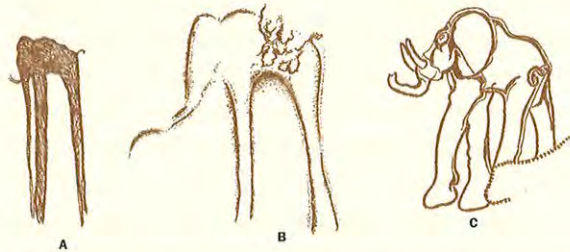
R. L. Anderson, *The Art of Primitive Societies*

If one can categorize art as a kind of play, then in that regard the case for a selective advantage for art would be a special extension of the case presented in the previous examples for play. But it is a dramatic extension; it deals with the frontier of our humanness. Given some individual variation, and a heritable component, it is easy to see how the arts—as in role-playing or acting, the buffer of humor, playing with and constructing fun objects (like doll clothes and forts), and making up stories—would have repercussions for later performance in critical utilitarian functions where imagination became crucial. Art, after all, is an exercise in magnifying life, exaggerating, distilling, recombining, and trying new recipes.





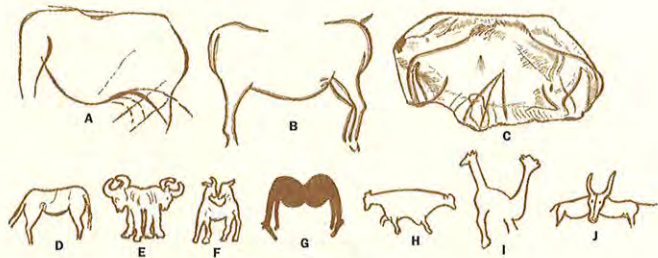
These drawings from Trois Frères, Fr., show animals with either two sets of horns (bison on the left) or both a set of horns and a set of antlers (reindeer on the right). Such outlandish images are not part of a pattern in Paleolithic art but appear to be made by drawers playing with imagery.



A. In the twentieth century, a mammoth carved on ivory turned up in a Siberian village. It reportedly came from the Berelekh paleontological site, from which hundreds of mammoth bones were removed. Its Paleolithic authenticity has been questioned; the unnaturally long legs, especially, have led some to consider it a forgery. However, a few other Paleolithic pieces do show mammoths drawn with unnaturally long legs, for example, the image (B) from Grèze, Fr. Later prehistoric art also shows similarly long-legged proboscideans: C, Elephant rock art drawing from Fezzan, Sahara.

A number of psychologists have documented that opportunities for artlike play enhance creative potential (e.g., Greenacre 1959; Torrance 1964; Lieberman 1965; Sutton-Smith 1967; Ellis and Scholtz 1978; Tower and Singer 1980; Cohen 1987), but data are not plentiful because traditionally the study of art and/or play as an important adaptive force has been neglected (Dolhinow and Bishop 1970). What is clear is that artistic kinds of play broaden brain function and activate a wide array of neural networks (Brown 1998) and brain regions. One can see that art may have enhanced communication as well as imagination. Though the direct utility of language has an obvious selective force for communication, art may have also played a role in the expansion of language capacities.

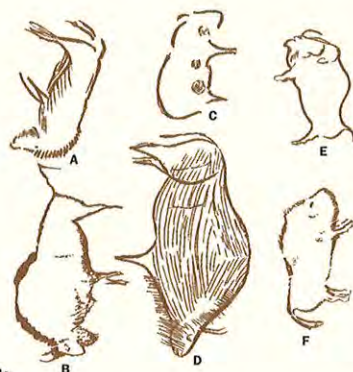
Certainly, creativity is universal among all human groups. But like most other traits, the advantages of cre-



Play in Prehistoric art. Paleolithic animals without a head in their brain: A, Les Combarelles, Fr. B, Addaura, It. C, Isturitz, Fr. (these two bison overlap, with their mirror-image rear portions emphasized). D, A similar two-rear image from Holocene Bushman rock art, Kinderdam, R.S.A. During the Holocene the reverse images were drawn in the Sahara, probably with humor: E, Palate de la Chasse. F, Suse. G, Wan-Bender. H, Sefar. I-J, Wādi-Djerāt.

ativity are not totally pervasive in every context. There are times and occasions where creation is crucial and times when not-rocking-the-boat, conservatively repeating what works, is the best solution. Creativity is not always beneficial or appropriate. But lots of evolutionary products are like that—held in reserve for appropriate expression. As an extreme exemplary reminder, the whole tail of some lizard species has an adaptive connection that allows it to snap off when it is grabbed by a predator. This may not happen to every individual, or even for several generations, but when it does happen, that complex anatomy more than pays for itself. Though not so simple as a snap-off tail, the propulsive dynamics of creativity stood a chance of occasionally jumping the chasm of change.

The human lifeway of a complexly social animal that lived as a physically rather inferior predator of large mammals necessitated creativity—and not just in weapon and shelter construction or food preparation. Our ancestors had to be able to cook up new recipes in all facets of life. Effective communication and logical analysis, the ability to imagine a future that was different, the flexibility to accept new political formats for decision making, to assume novel roles, and to negotiate complex situations with strangers, and the ability to look at old ideas with a fresh, new appraisal were all handy. Our niche needed people who got a kick out of pondering effects and causes. It favored persons able to tell a story or make a joke when the situation demanded a diffusion of tension or worry. Such



Paleolithic cave art includes some images of large quadrupeds that are presented vertically. These have elicited a variety of interpretations of mystical flavor. Some standing images have been interpreted as anthropomorphic shamans. But an item-by-item examination shows that there are more straightforward explanations. For example, many of these vertical quadrupeds are elaborations on natural contours that happen to suggest an animal in a vertical position: A, Le Portel, Fr. B, Santimamiñe, Sp. C-D, Altxerri, Sp. E, La Mouthe, Fr. F-G, Niaux, Fr.

traits are not selectively neutral; they distinguish more desirable leaders, friends, mates, or potential mates.

Oddly enough, we have no study of art making from that perspective, or of play for that matter. The reasons are complex, but they probably relate to the fact that potentially fascinating topics become invisible when we conceive of humans only as reproductive-age adults—children being unworthy of intellectual consideration. Aristotle, Locke, Leibniz, Spinoza, Hobbes, and Hume, who devoted their adult lives to seeking how human minds work, never even mentioned play. Plato, in his *Republic*, discussed how to educate philosopher-kings but never once referred to how they should play or make art. In fact, from Plato to Kant, philosophers have mistrusted both art and play (Murdock 1977) as a kind of lying. Nor is there evidence that it ever occurred to Darwin that either play or art could be adaptive, but he came close in one metaphor: “some instincts can hardly avoid looking as mere tricks or sometimes as play” (1859, 197).

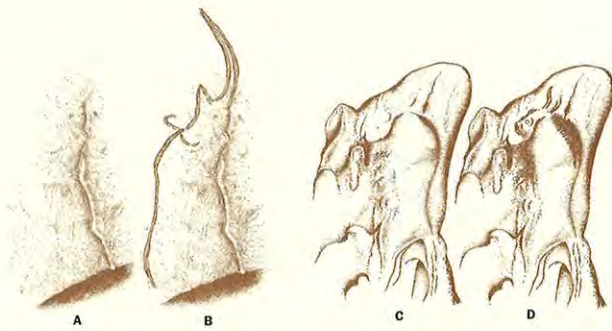
Why has not the idea of art as an adaptive trait, which activates and exercises our creativity and ability to innovate, seemed more obvious or more popular? Perhaps it is one of those things that loom too close—the subject is too

familiar for the objective eye to see behind it, just like the difficulty in art classes in coaxing people to draw a realistic human eye instead of that almond-enclosed circle symbol. It is the difficulty of conscious analysis to penetrate that part of the brain directly. There are numerous objective aspects about ourselves that are not easy to grasp because we are the subject.

It is a challenge, for instance, to objectively observe and interpret a smile or a laugh as an ethologist would, because we are usually engaged in the firsthand living of our lives and connecting with each other. To also be an aware objective observer is an awkward double role. Perhaps that is the reason it is so difficult to see play. Because art is right under our noses, we often fail to see the way this art making activates interest, intelligence, attentiveness, and flexibility. Also, the “official” role of visual art today does not help. ART, as in the idea of modes of visual art, is such a tangle in art schools, professional identity, and entertainment, not to speak of its commodification, that we start to wonder what is going on.

Finally, we are critical of slackers. In jobs of direct utility it is easy to assess whether people are carrying their share of the load. Other situations are less clear and the line between slacker and innovator may sometimes be very fine. It is a subject familiar to most parents of teenagers; remember the kids playing in the garage in the 1970s with all that junk which would eventually become personal computers. Neighbors of the Wright family bicycle shop undoubtedly thought at some point that these two bachelor brothers should give up their boyish interests in air-sailing and get on with useful lives.

How is all this relevant to the natural history of Paleolithic art? First of all, it highlights that the drawings were not labor and, further, that much of the art may have lacked an explicit, formal purpose. There is too much that is simply lighthearted, individualistically diverse, and too delightful. Certainly, attractive or technically excellent pieces in Paleolithic art do testify to the skills of people who spent many rewarding hours making art. But most of

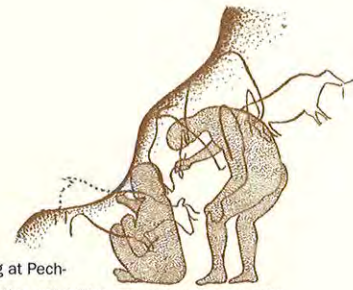


A, Chauvet Cave, Fr. A crack in the cave wall reminded someone of the lower contour of a rhino. B, C, A rock from El Castillo, Sp., with natural forms that suggest a vertical bison. D, The Paleolithic artist enhanced these with pigment. The vertical bison or rhino has been described as some mystical "anthropomorph," but one can see how the humped rocks might suggest a familiar image.

all, this old art testifies to the evolution of a major human quality, the very essence of humanness. Entangled in fantasy, it was done in play, yet something serious and fundamental was occurring. Underlying the colored bison, the red splotches of hand outlines, and the scratched images of swollen genitals we can surmise something besides the momentary expression they provided the doer or the impression they have on the viewer. Art making appears to be in our genes.

#### ARE THE VARIATIONS IN ART OR CREATIVITY HERITABLE?

We can see behaviors among ravens and chimps that certainly are related to human creativity, and we can be confident that evolutionary differences among organisms are derived from genetic differences. But within any one group what fraction of these behaviors is heritable? This question is almost unapproachable, and if we try to find appropriate data, all that is available will seem both simplistic and reductionistic. Creativity, by its own definition, involves coming up with something new. Any contrivances we make to test something so complex are going to be incomplete. There are, however, some oblique approximations available, obtained by working around the edges. For example, we know roughly what creative versatility is not. It is not an unshakable adherence to the given, the received, and we can measure that. That adherence is



Lorblanchet has proposed that the aurochs image under the stone overhang at Pech-Merle, Fr., was done vertically because the artist (the one shown here on the right) had to twist into a sideways position to be able to make it. My drawing, after Lorblanchet 1991.

called *traditionalism* in psychological testing. It is characterized by going to the same church you were born into, preferring the same general region in which you were raised, believing in roughly the same things as your parents, having basically their same tastes, etc. People vary in this resistance to personal change and considering new paradigms. The Minnesota Twin Study (Bouchard et al. 1990) measured the heritability of traditionalism at 0.53; that is, about half of the variation can be accounted for by genetic propensities. This "backside reflection" gives us some approximation of versatility, which at least is an aspect of creativity. It indeed seems moderately heritable.

But does human artistic propensity or ability have a heritability? Do people vary genetically in their propensity for art involvement, ease of art skill development, and range of ability? Common experience with musical ability and drawing skills within families suggests specific kinds do, but to my knowledge there has been little work on some approximation of heritability.

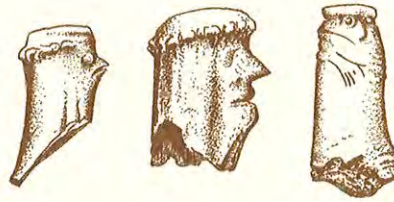
#### THE SELECTIVE COSTS OF ART

As with play, there are costs to art making. Indeed, art and direct utility seem to be at opposite poles, yet art is such a central and natural part of our lives, universal to all human groups, that it deserves a better accounting. We confidently assign the highest profile to utility and industry. Yet this may be a double blindness—both underestimating the vital role of creative endeavors in our own lives and the playful touch that created so much of what we proudly tout as progress and no-nonsense functionality.

So many things we take for granted add indirectly to our reproductive fitness. Our days are largely taken up with activities that ultimately arise from our art-making capacity. These activities are costly in time, money, and energy. Our ideas about and appreciation of art are given birth in hobbies, travel, beautiful gadgets like baked-enamel cars, comfortable and attractive clothes, homes with appealing architecture and furnishings, sports, books, electronic entertainment, and so much else. In the scales of evolutionary fitness there must be some counterbalancing force that counteracts these costs. In the end it has to be the powerful human imagination that is activated and honed by these pleasures. Shards of carved antler, engraved ivory, and the painted cave walls inform us that pleasure in art has been with us for many tens of thousands of years.

Apparently, lots of energy was devoted to art then as well. Many hundreds of these art pieces have survived from the Paleolithic. Imagine the scene: someone is sitting cross-legged on the ground carving an atlatl while he listens to and chats with others, among the noises of the small camp. Smoke shifts back and forth on the wafting breeze, which also conveys the odors of unwashed bodies, greasy leather clothing, decaying bone refuse and fly-blown debris, and the sweet smell of roasting meat. Scrrrape, Scrrrape, the sharp stone takes off a little of the water-softened antler at each stroke. Many hundreds of strokes lie ahead before the carver is finished. Such construction is not just a matter of naked utility. Looking back from his future, we are privileged to know the outcome in this case—the atlatl will take the shape of a leaping horse, the spur to connect with the dart is already protruding from the roughed underside of the jaw, like a tuft of beard. The finished piece will be something very different from a strictly utilitarian tool.

Thousands upon thousands of precious hours were devoted to such art making. And of course our preserved slice records the merest fraction of objects. Dances, music, stories, and more left no trace. The Paleolithic art that re-



The little burrs and projections near the base of shed antlers suggest all kinds of images that can be modified to highlight them further. These are all from Holstein, Ger.

mains is enough to confirm that humans are prone to such creative endeavors. It implies that this vivifying elaboration and expression are derived from an elemental need, a hunger that is satisfied only with the essential nutrient of art making. Fulfilling who and what we are, it is the imagined that highlights the real. Utility is not enough; it is what ants do. But why humans? Why did earlier hominids not do this in such a major way?

#### THE SURGE OF ART IN THE LATE PALEOLITHIC

*Homo erectus* and *Homo neanderthalensis* were not so different from humans: they built lean-to shelters, stoked their campfires, laced together warm clothing, and probably plotted hunting strategies, and maybe even gossiped. The record even suggests a little art in their lives: for example, the inclusion of a beautiful fossil embedded in the center of a flint hand ax. There was likely more art in their lives than was preserved in the archaeological record. But comparisons are clearly a matter of degree, and when the artifacts of humans are compared with those of other members of our genus, we find some major differences.

The appearance of visual art, soon after humans began to appear in the fossil record, seems nothing short of an outburst, as Julian Huxley emphasized in the opening epigraph of this chapter. If we are correct in pointing to art making as an offshoot of play that serves to activate creativity, then we would expect other things to accompany the emergence of art making in the archaeological record—things like a greater complexity in social cooperation, communication, exchange of goods, including



This woolly rhino is drawn with an attempt at foreshortened angles, yet the inexperience of the artist shows. We are lucky to be able to make a species identification; without its nose-horn it could have been identified as any number of animals. Lascaux, Fr.

Playing with two heads and one body. Delightful horse and ibex engraved on the walls of Pair-non-Pair, Fr. It appears that the ibex was added, along with a cloven hoof, after the horse had been engraved. This image is often mistakenly redrawn as a foreshortened horse.



Instead of a single body and two heads, here we have multiple bodies and a single head. This artful design is from much a later time in India, at Ajunta Cave.

rapid diffusion of information, inventions, and discoveries. And we might see a quantitative sign of these changes reflected in growing population numbers, as expressed in more campsites of slightly larger size and density. Indeed, more complex and more specialized tools, more effective weaponry, evidence of more sophisticated clothing, and expansion into areas previously uninhabited do accompany the late Paleolithic outburst of human art making.

The emergence of art making was evidently part of extensive changes in human evolution, involving, among other things, some major brain reorganization. But why did it not happen in these other species of *Homo*? Bear in mind that these other hominids were unlikely to have experienced any raw, day-to-day evolutionary incompleteness. In their way, they were quite successful. Humans just upped the ante with regard to imagination and flexibility. This departure in human evolution was likely due to the alignment of some unusual circumstances. Perhaps it was the combination of an already innovative African hominid and an unusual climate and biotic opportunities during the last Interstadial, roughly 30,000–100,000 years ago. This was a time when the climate was generally more equable than the present in many ways, yet immensely

more unstable. There must have been repeated abrupt swings from scarcity to richness in diversity and density of large-mammal species. Humans were confronted with jerky cycles of extraordinary opportunities and difficult challenges—where a thoughtful and creative hominid excelled.

But our minds boggle when we try to glimpse the evolution of this creative intellect—using that ability to contemplate the origins of itself. That is another form of art.

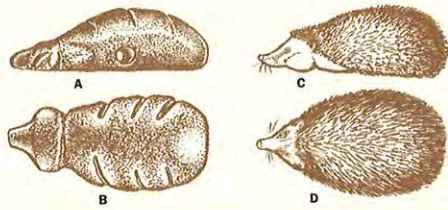
### Scholarship, Science, and Art as Human Play

Good science consists largely of play disguised as work.

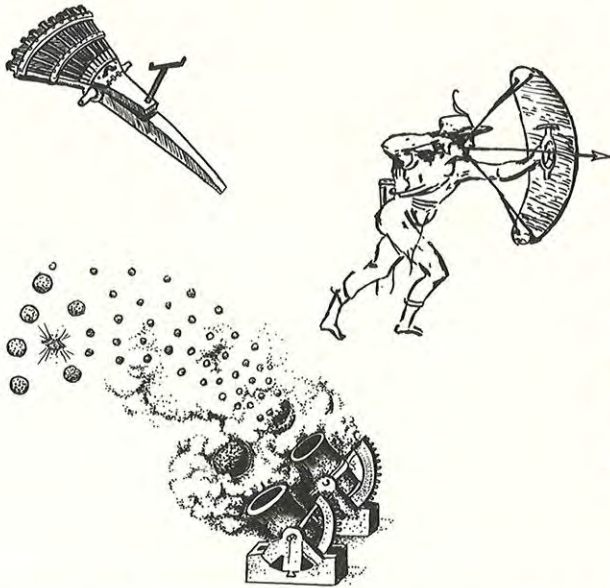
E. O. Wilson, *Consilience*

It should be clear by now that my sense of art making's playful essence is so broad as to be connected to virtually all creative endeavors. Many other modes of creativity might come to mind before the practice of science, but science (or, as Wilson noted, good science) is provoked by an innate attraction to the pleasures of wondering and understanding. People vary a lot in how much pleasure they get out of this kind of venture, even professionally trained scientists. In fact, training may have little to do with it. B. F. Skinner puzzled over this in his commentary on science: "It is a bold thing to say that we know how to train a man to be a scientist. Scientific thinking is the most complex and probably the most subtle of all human activities" (1956, 222). A background of rich youthful play and art in its broader definition seems to be a critical feature of most creative and outstanding scholars and scientists (Brown 1998).

Creativity is something more than just doing things differently or unconstrained novelty. It is about beautiful alternatives within apt constraints. In science, for example, the active players embrace contextually fitting principles because of their elegance, even though these principles are often rather amorously understood and



A–B, This miniature Paleolithic carving (ornament?) from Petersfels, Ger., seems to be a hedgehog (*Erinaceus europa*), a creative way to handle a difficult subject. C–D are my drawings of a hedgehog.



Human evolution has made us more childlike in many ways, particularly with regard to play and art. One could argue that some of Leonardo da Vinci's immense talent was due to his retaining an adolescent-like enthusiasm for so many things. And, indeed, so many of his designs were subjects of interest to a young boy. His notebooks abound with creatively new devices of violence: fortifications, siege breakers, weaponry, etc. Here are three ingenious ideas: multiple-barreled gun, bow-shield, and mortars that shot exploding shells. After a sketch in Leonardo's notebooks.

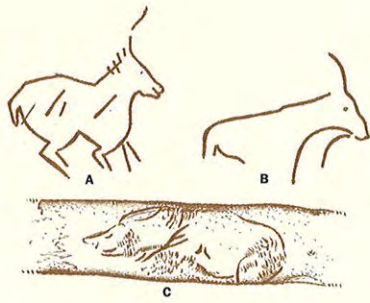
difficult to inculcate. Mostly those new ideas are evaluated on their originality and excellence of insights by the consilient interlinkage of their explanatory power, but always within the constraints of reason. Likewise, even in child's play, games operate with rules, chaos becomes ordered within broad boundaries, and when these are circum-

vented the play world often collapses. Real creativity flourishes within apt constraints; it is not totally wild and incoherent. The same has always been true of poignant visual art, music, poetry, and so on. And this paradoxical kind of freedom is laced all through the best of human enterprises.

It seems that various aptitudes for art and rational thinking within the constraints of reason usually develop very readily in children, though they are unfathomably complex if one tries to dissect the processes. How can we preserve and nurture these aptitudes? Perhaps the answer is, by a lot of early unharnessed play, exploring the constraints of freedom. In *Emile* Jean-Jacques Rousseau said: "May I set forth at this point the most important and the most useful rule in all education? It is not to save time but to waste it. Nature wants children to be children before they are men. If we deliberately depart from this order we shall get premature fruits which are neither ripe nor well flavored and which soon decay. We shall have youthful sages and grown up children" (1993, 23). Judging from their art, that seems to have been the Paleolithic standard of youthful fun.

### Not Art for Art's Sake . . .

Our limbic rewards evolved to adaptively adjust our activities, making some things feel good and others not so good. Reynolds (1973) showed that creative play is so internally driven that rewards, beyond general support, did not increase it and sometimes even subverted the creative process. It is like trying to formulate how to talk a healthy person into eating pie made from good peaches, fresh out of the oven, and topped with ice cream. Most art making, like singing or drawing, also needs no external reward. The patterns and forms of Paleolithic art reassure us that art behavior in the late Pleistocene was also driven by internal rewards and was not viewed as labor or as the creation of symbols for particular purposes, as the twentieth-century



Just remember, even a beginning drawer with a simple piece of charcoal or a sharp rock could make a few lines and—poof!—create an animal. It must have been a real high in the Pleistocene, long before videos, movies, magazines, and photographs set us awash in a sea of images. Even a very young person could do it on any public space—as much as one wanted, it wasn't illegal. A, Kleinschulerloch, Ger. B, Kastlhöhle, Ger. C, La Vache, Fr.

academics have seen it. Paleolithic art was done by people who had episodes of free time, occasional plenty, and the social context that encouraged play. Further, I suspect much of it was done at a time in life when creative play provided the most fun. So calling it “art for art’s sake” may not be quite accurate. And though fun was the organic driver for art, it has deeper evolutionary agendas. In that role it is much more than a cluster of symbols for secondary meanings or some epiphenomenon of being human. Rather, Paleolithic art is that first clear spoor of advancing creativity in the human line—as Dissanayake said, “not art for art’s sake, but art for life’s sake” (1992, 12).



*Kids doodling on the walls, playing in their secret camp, talking big of bears and sexual goodies . . . picture it. They are carefully tutored by the older-kid tradition inside the freedom of long unschooled days, playing at the calisthenics of logic and imagination. Once such a boy, I can nearly speak their minds, squat in the same cave dampness, and see the moving shadows beneath the ghostly white-hand negatives. What an incredible yarn an old club-member could spin for them—my own mix of science and art. Too far beyond their need-to-know, they would not believe the alchemy of hormones swelling their glands and minds, waves of ionic depolarization the physics of their thoughts, their brain halves sparking binary bits, radiowave hiss of an expanding universe, giant planets pinpricks of light in the evening sky, worlds like, but unlike, our own, cooled molten balls from the gasses that firmed our own firmament, shifting crusty continents underfoot, mother evolution—mammoths from tiny ancestors, us leaning against lovely limestone rocks ancient seafloor skeletons, flowers a trick on insect pollinators, fruit the bait for seed dispersers, our lunch salmon’s round-trip across blue waters beyond dimension. Wild talk. A strange and beautiful game the clan has made, playing at tales of science and art . . . perhaps the ultimate sport.*