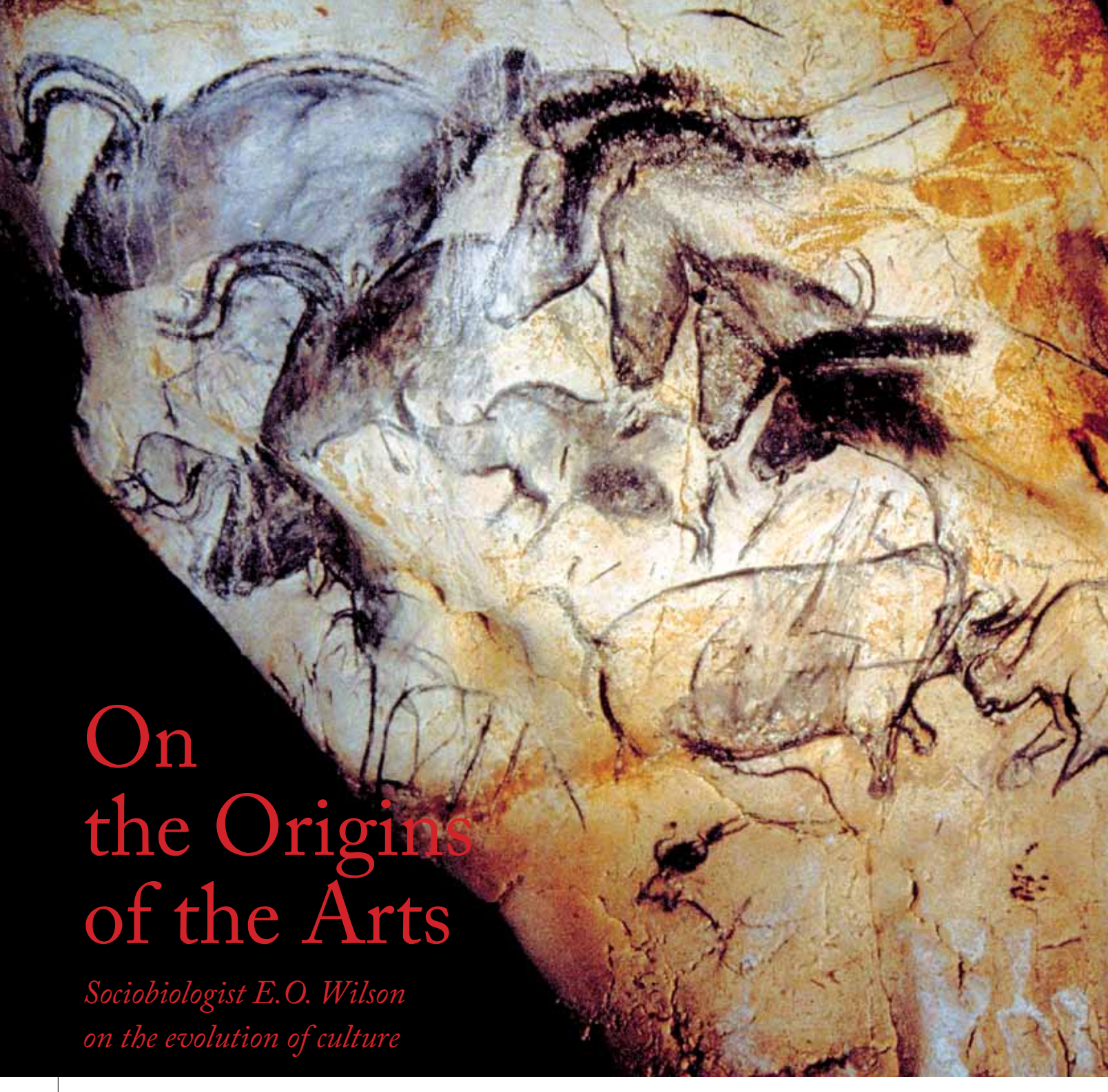

On the Origins of the Arts

Sociobiologist E.O. Wilson on the evolution of culture

Rich and seemingly boundless as the creative arts seem to be, each is filtered through the narrow biological channels of human cognition. Our sensory world, what we can learn unaided about reality external to our bodies, is pitifully small. Our vision is limited to a tiny segment of the electromagnetic spectrum, where wave frequencies in their fullness range from gamma radiation at the upper end, downward to the ultralow frequency used in some specialized forms of communication. We see only a tiny bit in the middle of the whole, which we refer to as the "visual spectrum." Our optical apparatus divides this accessible piece into the fuzzy divisions we call colors. Just beyond blue in frequency is ultraviolet, which insects can see but we cannot. Of the sound frequencies all around us we hear only a few. Bats orient with the echoes of ultrasound, at a frequency too high for our ears, and elephants communicate with grumbling at frequencies too low.

Tropical mormyrid fishes use electric pulses to orient and communicate in opaque murky water, having evolved to high efficiency a sensory modality entirely lacking in humans. Also, unfelt by

us is Earth's magnetic field, which is used by some kinds of migratory birds for orientation. Nor can we see the polarization of sunlight from patches of the sky that honeybees employ on cloudy days to guide them from their hives to flower beds and back.

Our greatest weakness, however, is our pitifully small sense of taste and smell. Over 99 percent of all living species, from microorganisms to animals, rely on chemical senses to find their way through the environment. They have also perfected the capacity to communicate with one another with special chemicals called pheromones. In contrast, human beings, along with monkeys, apes, and birds, are among the rare life forms that are primarily audiovisual, and correspondingly weak in taste and smell. We are idiots compared with rattlesnakes and bloodhounds. Our poor ability to smell and taste is reflected in the small size of our chemosensory vocabularies, forcing us for the most part to fall back on similes and other forms of metaphor. A wine has a delicate bouquet, we say, its taste is full and somewhat fruity. A scent is like that of a rose, or pine, or rain newly fallen on the earth.

We are forced to stumble through our chemically challenged lives in a chemosensory biosphere, relying on sound and vision that evolved primarily for life in the trees. Only through science and technology has humanity penetrated the immense sensory worlds in the rest of the biosphere. With instrumentation, we are able to translate the sensory worlds of the rest of life into our own. And in the process, we have learned to see almost to the end of the universe, and estimated the time of its beginning. We will never orient by feeling Earth's magnetic field, or sing in pheromone, but we can bring all such information existing into our own little sensory realm.

By using this power in addition to examine human history, we can gain insights into the origin and nature of aesthetic judgment. For example, neurobiological monitoring, in particular measurements of the damping of alpha waves during perceptions of abstract designs, have shown that the brain is most aroused by patterns in which there is about a 20 percent redundancy of elements or, put roughly, the amount of complexity found in a simple maze, or two turns of a logarithmic spiral, or an asymmetric cross. It may be coincidence (although I think not) that about the same degree of complexity is shared by a great deal of the art in friezes, grillwork, colophons, logographs, and flag designs. It crops up again in the glyphs of the ancient Middle East and Mesoamerica, as well in the pictographs and letters of modern Asian languages. The same level of complexity characterizes part of what is considered attractive in primitive art and modern abstract art and design. The source of the principle may be that this amount of complexity is the most that the brain can process in a single glance, in the same way that seven is the highest number of objects that can be counted at a single glance. When a picture is more complex, the eye grasps its content by the eye's saccade or consciously reflective travel from one sector to the next. A quality of great art is its ability to guide attention from one of its parts to another in a manner that pleases, informs, and provokes.

The human urge to create art appears magnificently in the Paleolithic paintings from roughly 30,000 years ago at Chauvet Cave, in southern France. Here, the Panel of the Horses.

In another sphere of the visual arts there is biophilia, the innate affiliation people seek with other organisms, and especially with the living natural world. Studies have shown that given freedom to choose the setting of their homes or offices, people across cultures gravitate toward an environment that combines three features, intuitively understood by landscape architects and real estate entrepreneurs. They want to be on a height looking down, they prefer open savanna-like terrain with scattered trees and copses, and they want to be close to a body of water, such as a river, lake, or ocean. Even if all these elements are purely aesthetic and not functional, home buyers will pay any affordable price to have such a view.

People, in other words, prefer to live in those environments in which our species evolved over millions of years in Africa. Instinctively, they gravitate toward savanna forest (parkland) and transitional forest, looking out safely over a distance toward reliable sources of food and water. This is by no means an odd connection, if considered as a biological phenomenon. All mobile animal species are guided by instincts that lead them to habitats in which they have a maximum chance for survival and reproduction. It should come as no surprise that during the relatively short span since the beginning of the Neolithic, humanity still feels a residue of that ancient need.

If ever there was a reason for bringing the humanities and science closer together, it is the need to understand the true nature of the human sensory world, as contrasted with that seen by the rest of life. But there is another, even more important reason to move toward consilience among the great branches of learning. Substantial evidence now exists that human social behavior arose genetically by multilevel evolution. If this interpretation is correct, and a growing number of evolutionary biologists and anthropologists believe it is, we can expect a continuing conflict between components of behavior favored by individual selection and those favored by group selection. Selection at the individual level tends to create competitiveness and selfish behavior among group members—in status, mating, and the securing of resources. In opposition, selection between groups tends to create selfless behavior, expressed in greater generosity and altruism, which in turn promote stronger cohesion and strength of the group as a whole.

An inevitable result of the mutually offsetting forces of multilevel selection is permanent ambiguity in the individual human mind, leading to countless scenarios among people in the way they bond, love, affiliate, betray, share, sacrifice, steal, deceive, redeem, punish, appeal, and adjudicate. The struggle endemic to each person's brain, mirrored in the vast superstructure of cultural evolution, is the fountainhead of the humanities. A Shakespeare in the world of ants, untroubled by any such war between honor and treachery, and chained by the rigid commands of instinct to a tiny repertory of feeling, would be able to write only one drama of triumph and one of tragedy. Ordinary people, on the other hand, can invent an endless variety of such stories, and compose an infinite symphony of ambience and mood.

What exactly, then, are the humanities? An earnest effort to define them is to be found in the U.S. congressional statute of 1965, which established the National Endowment for the Humanities and the National Endowment for the Arts:

> The term "humanities" includes, but is not limited to, the study of the following: language, both modern and classical; linguistics; literature; history; jurisprudence; philosophy; archaeology; comparative religion; ethics; the history,

Photographs courtesy of the French Ministry of Culture and Communication, Regional Direction for Cultural Affairs, Rhône-Alpes region/Regional department of archaeology

criticism, and theory of the arts; those aspects of social sciences which have humanistic content and employ humanistic methods; and the study and application of the humanities to the human environment with particular attention to reflecting our diverse heritage, traditions, and history and to the relevance of the humanities to the current conditions of national life.

Such may be the scope of the humanities, but it makes no allusion to the understanding of the cognitive processes that bind them all together, nor their relation to hereditary human nature, nor their origin in prehistory. Surely we will never see a full maturing of the humanities until these dimensions are added.

Since the fading of the original Enlightenment during the late eighteenth and early nineteenth centuries, stubborn impasse has existed in the consilience of the humanities and natural sciences. One way to break it is to collate the creative process and writing styles of literature and scientific research. This might not prove so difficult as it first seems. Innovators in both of two domains are basically dreamers and storytellers. In the early stages of creation of both art and science, everything in the mind is a story. There is an imagined denouement, and perhaps a start, and a selection of bits and pieces that might fit in between. In works of literature and science alike, any part can be changed, causing a ripple among the other parts, some of which are discarded and new ones added. The surviving fragments are variously joined and separated, and moved about as the story forms. One scenario emerges, then another. The scenarios, whether literary or scientific in nature, compete. Words and sentences (or equations or experiments) are tried. Early on an end to all the imagining is conceived. It seems a wondrous denouement (or scientific breakthrough). But is it the best, is it true? To bring the end safely home is the goal of the creative mind. Whatever that might be, wherever located, however expressed, it begins as a phantom that might up until the last moment fade and be replaced. Inexpressible thoughts flit along the edges. As the best fragments solidify, they are put in place and moved about, and the story grows and reaches its inspired end. Flannery O'Connor asked, correctly, for all of us, literary authors and scientists, "How can I know what I mean until I see what I say?" The novelist says, "Does that work?," and the scientist says, "Could that possibly be true?"

A bison, shown in twisted perspective; the doubling of the hindquarters and the extra legs may depict the animal running, or two bison side by side.

The successful scientist thinks like a poet but works like a bookkeeper. He writes for peer review in hopes that "statured" scientists, those with achievements and reputations of their own, will accept his discoveries. Science grows in a manner not well appreciated by nonscientists: it is guided as much by peer approval as by the truth of its technical claims. Reputation is the silver and gold of scientific careers. Scientists could say, as did James Cagney upon receiving an Academy Award for lifetime achievement, "In this business you're only as good as the other fellow thinks you are."

But in the long term, a scientific reputation will endure or fall upon credit for authentic discoveries. The conclusions will be tested repeatedly, and they must hold true. Data must not be questionable, or theories crumble. Mistakes uncovered by others can cause a reputation to wither. The punishment for fraud is nothing less than death—to the reputation, and to the possibility of further career advancement. The equivalent capital crime in literature is plagiarism. But not fraud! In fiction, as in the other creative arts, a free play of imagination is expected. And to the extent it proves aesthetically pleasing, or otherwise evocative, it is celebrated.

The essential difference between literary and scientific style is the use of metaphor. In scientific reports, metaphor is permissible—provided it is chaste, perhaps with just a touch of irony and self-deprecation. For example, the following would be permitted in the introduction or discussion of a technical report: "This result if confirmed will, we believe, open the door to a range of further fruitful investigations." Not permitted is: "We envision this result, which we found extraordinarily hard to obtain, to be a potential watershed from which many streams of new research will surely flow."

What counts in science is the importance of the discovery. What matters in literature is the originality and power of the metaphor. Scientific reports add a tested fragment to our knowledge of the material world. Lyrical expression in literature, on the other hand, is a device to communicate emotional feeling directly from the mind of the writer to the mind of the reader. There is no such goal in scientific reporting, where the purpose of the author is to persuade the reader by evidence and reasoning of the validity and importance of the discovery. In fiction the stronger the desire to share emotion, the more lyrical the language must be. At the extreme, the statement may be obviously false, because author and reader want it that way. To the poet the sun rises in the east and sets in the west, tracking our diel cycles of activity, symbolizing birth, the high noon of life, death, and rebirth—even though the sun makes no such movement. It is just the way our distant ancestors visualized the celestial sphere and

The Lion Panel, with bison (the lions' likely prey), a young mammoth, and rhinoceros

the starry sky. They linked its mysteries, which were many, to those in their own lives, and wrote them down in sacred script and poetry across the ages. It will be a long time before a similar venerability in literature is acquired by the real solar system, in which Earth is a spinning planet encircling a minor star.

On behalf of this other truth, that special truth sought in literature, E. L. Doctorow asks,

> Who would give up the *Iliad* for the "real" historical record? Of course the writer has a responsibility, whether as solemn interpreter or satirist, to make a composition that serves a revealed truth. But we demand that of all creative artists, of whatever medium. Besides which a reader of fiction who finds, in a novel, a familiar public figure saying and doing things not reported elsewhere knows he is reading fiction. He knows the novelist hopes to lie his way to a greater truth than is possible with factual reportage. The novel is an aesthetic rendering that would portray a public figure interpretively no less than the portrait on an easel. The novel is not read as a newspaper is read; it is read as it is written, in the spirit of freedom.

Picasso expressed the same idea summarily: "Art is the lie that helps us to see the truth."

The creative arts became possible as an evolutionary advance when humans developed the capacity for abstract thought. The human mind could then form a template of a shape, or a kind of object, or an action, and pass a concrete representation of the conception to another mind. Thus was first born true, productive language, constructed from arbitrary words and symbols. Language was followed by visual art, music, dance, and the ceremonies and rituals of religion.

The exact date at which the process leading to authentic creative arts is unknown. As early as 1.7 million years ago, ancestors of modern humans, most likely *Homo erectus,* were shaping crude teardrop-shaped stone tools. Held in the hand, they were probably used to chop up vegetables and meat. Whether they were also held in the mind as a mental abstraction, rather than merely created by imitation among group members, is unknown.

By 500,000 years ago, in the time of the much brainier *Homo heidelbergensis,* a species intermediate in age and anatomy between *Homo erectus* and *Homo sapiens,* the hand axes had become more sophisticated, and they were joined by carefully crafted stone blades and projectile points. Within another 100,000 years, people were using wooden spears, which must have taken several days and multiple steps to construct. In this period, the Middle Stone Age, the human ancestors began to evolve a technology based on a true, abstraction-based culture.

Next came pierced snail shells thought to be used as necklaces, along with still more sophisticated tools, including well-designed bone points. Most intriguing are engraved pieces of ocher. One design, 77,000 years old, consists of three scratched lines that connect a row of nine X-shaped marks. The meaning, if any, is unknown, but the abstract nature of the pattern seems clear.

Burials began at least 95,000 years ago, as evidenced by thirty individuals excavated at Qafzeh Cave in Israel. One of the dead, a nine-year-old child, was positioned with its legs bent and a deer antler in its arms. That arrangement alone suggests not just an abstract awareness of death but also some form of existential anxiety. Among today's hunter-gatherers, death is an event managed by ceremony and art.

The beginnings of the creative arts as they are practiced today may stay forever hidden. Yet they were sufficiently established by genetic and cultural evolution for the "creative explosion" that began approximately 35,000 years ago in Europe. From this time on until the Late Paleolithic period over 20,000 years later, cave art flourished. Thousands of figures, mostly of large game animals, have been found in more than two hundred caves distributed through southwestern France and northeastern Spain, on both sides of the Pyrenees. Along with cliffside drawings in other parts of the world, they present a stunning snapshot of life just before the dawn of civilization.

The Louvre of the Paleolithic galleries is at the Grotte Chauvet in the Ardèche region of southern France. The masterpiece among its productions, created by a single artist with red ocher, charcoal, and engraving, is a herd of four horses (a native wild species in Europe at that time) running together. Each of the animals is represented by only its head, but each is individual in character. The herd is tight and oriented obliquely, as though seen from slightly above and to the left. The edges of the muzzles were chiseled into bas relief to bring them into greater prominence. Exact analyses of the figures have found that multiple artists first painted a pair of rhinoceros males in head-to-head combat, then two aurochs (wild cattle) facing away. The two groups were placed to leave a space in the middle. Into the space the single artist stepped to create his little herd of horses.

The rhinos and cattle have been dated to 32,000–30,000 years before the present, and the assumption has been that the horses

are that old as well. But the elegance and technology evident in the horses have led some experts to reckon their provenance as dating to the Magdalenian period, which extended from 17,000 to 12,000 years ago. That would align the origin with the great works on the cave walls of Lascaux in France and Altamira in Spain.

Apart from the exact date of the Chauvet herd's antiquity, the important function of the cave art remains uncertain. There is no reason to suppose the caves served as proto-churches, in which bands gathered to pray to the gods. The floors are covered with the remains of hearths, bones of animals, and other evidences of long-term domestic occupation. The first *Homo sapiens* entered central and eastern Europe around 45,000 years ago. Caves in that period obviously served as shelters that allowed people to endure harsh winters on the Mammoth Steppe, the great expanse of grassland that extended below the continental ice sheet across the whole of Eurasia and into the New World.

Perhaps, some writers have argued, the cave paintings were made to conjure sympathetic magic and increase the success of hunters in the field. This supposition is supported by the fact that a great majority of the subjects are large animals. Furthermore, 15 percent of these animal paintings depict animals that have been wounded by spears or arrows.

Additional evidence of a ritualistic content in the European cave art has been provided by the discovery of a painting of what is most likely a shaman with a deer headdress, or possibly a real deer's head. Also preserved are sculptures of three "lion-men," with human bodies and the heads of lions—precursors of the chimeric half-animal-half-gods later to show up in the early history of the Middle East. Admittedly, we have no testable idea of what the shaman did or the lion-men represented.

A contrary view of the role of cave art has been advanced by the wildlife biologist R. Dale Guthrie, whose masterwork *The Nature of Paleolithic Art* is the most thorough on the subject ever published. Almost all of the art, Guthrie argues, can be explained as the representations of everyday Aurignacian and Magdalenian life. The animals depicted belong to the species the cave dwellers regularly hunted (with a few, like lions, that may have hunted people), so naturally that would be a regular subject for talk and visual communication. There were also more figures of humans or at least parts of the human anatomy that are usually not mentioned in accounts of cave art. These tend to be pedestrian. The inhabitants often made prints by holding their hands on the wall and spewing ocher powder from their mouths, leaving an outline of spread thumb and fingers behind. The size of the hands indicates that it was mostly children who engaged in this activity. A good many graffiti are present as well, with meaningless squiggles and crude representations of male and female genitalia common among them. Sculptures of grotesque obese women are also present and may have been offerings to the spirits or gods to increase fertility—the little bands needed all the members they could generate. On the other hand, the sculptures might as easily have been an exaggerated representation of the plumpness in women desired during the frequent hard times of winter on the Mammoth Steppe.

The utilitarian theory of cave art, that the paintings and scratchings depict ordinary life, is almost certainly partly correct, but not entirely so. Few experts have taken into account that there also occurred, in another wholly different domain, the origin and use of music. This event provides independent evidence that at least some of the paintings and sculptures did have a magical content in the lives of the cave dwellers. A few writers have argued that music had no Darwinian significance, that it sprang from language as a pleasant "auditory cheesecake," as one author once put it. It is true that scant evidence exists of the content of the music itself—just as, remarkably, we have no score and therefore no record of Greek and Roman music, only the instruments. But musical instruments also existed from an early period of the creative explosion. "Flutes," technically better classified as pipes, fashioned from bird bones, have been found that date to 30,000 years or more before the present. At Isturitz in France and other localities some 225 reputed pipes have been so classified, some of which are of certain authenticity. The best among them have finger holes set in an oblique alignment and rotated clockwise to a degree seemingly meant to line up with the fingers of a human hand. The holes are also beveled in a way that allows the tips of the fingers to be sealed against them. A modern flutist, Graeme Lawson, has played a replica made from one of them, albeit of course without a Paleolithic score in hand.

Red bear

Other artifacts have been found that can plausibly be interpreted as musical instruments. They include thin flint blades that, when hung together and struck, produce pleasant sounds like those from wind chimes. Further, although perhaps just a coincidence, the sections of walls on which cave paintings were made tend to emit arresting echoes of sound in their vicinity.

Was music Darwinian? Did it have survival value for the Paleolithic tribes that practiced it? Examining the customs of contemporary hunter-gatherer cultures from around the world, one can hardly

come to any other conclusion. Songs, usually accompanied by dances, are all but universal. And because Australian aboriginals have been isolated since the arrival of their forebears about 45,000 years ago, and their songs and dances are similar in genre to those of other hunter-gatherer cultures, it is reasonable to suppose that they resemble the ones practiced by their Paleolithic ancestors.

Anthropologists have paid relatively little attention to contemporary hunter-gatherer music, relegating its study to specialists on music, as they are also prone to do for linguistics and ethnobotany (the study of plants used by the tribes). Nonetheless, songs and dances are major elements of all hunter-gatherer societies. Furthermore, they are typically communal, and they address an impressive array of life issues. The songs of the well-studied Inuit, Gabon pygmies, and Arnhem Land aboriginals approach a level of detail and sophistication comparable to those of advanced modern civilizations. The musical compositions of modern hunter-gatherers generally serve basically as tools that invigorate their lives. The subjects within the repertoires include histories and mythologies of the tribe as well as practical knowledge about land, plants, and animals.

JEAN CLOTTES/FRENCH MINISTRY OF CULTURE AND COMMUNICATION

One rhinoceros from a group of 17

Of special importance to the meaning of game animals in the Paleolithic cave art of Europe, the songs and dances of the modern tribes are mostly about hunting. They speak of the various prey; they empower the hunting weapons, including the dogs; they appease the animals they have killed or are about to kill; and they offer homage to the land on which they hunt. They recall and celebrate successful hunts of the past. They honor the dead and ask the favor of the spirits who rule their fates.

It is self-evident that the songs and dances of contemporary hunter-gatherer peoples serve them at both the individual and the group levels. They draw the tribal members together, creating a common knowledge and purpose. They excite passion for action. They are mnemonic, stirring and adding to the memory of information that serves the tribal purpose. Not least, knowledge of the songs and dances gives power to those within the tribe who know them best.

To create and perform music is a human instinct. It is one of the true universals of our species. To take an extreme example, the neuroscientist Aniruddh D. Patel points to the Pirahã, a small tribe in the Brazilian Amazon: "Members of this culture speak a language without numbers or a concept of counting. Their language has no fixed terms for colors. They have no creation myths, and they do not draw, aside from simple stick figures. Yet they have music in abundance, in the form of songs."

Patel has referred to music as a "transformative technology." To the same degree as literacy and language itself, it has changed the way people see the world. Learning to play a musical instrument even alters the structure of the brain, from subcortical circuits that encode sound patterns to neural fibers that connect the two cerebral hemispheres and patterns of gray matter density in certain regions of the cerebral cortex. Music is powerful in its impact on human feeling and on the interpretation of events. It is extraordinarily complex in the neural circuits it employs, appearing to elicit emotion in at least six different brain mechanisms.

Music is closely linked to language in mental development and in some ways appears to be derived from language. The discrimination patterns of melodic ups and downs are similar. But whereas language acquisition in children is fast and largely autonomous, music is acquired more slowly and depends on substantial teaching and practice. There is, moreover, a distinct critical period for learning language during which skills are picked up swiftly and with ease, whereas no such sensitive period is yet known for music. Still, both language and music are syntactical, being arranged as discrete elements—words, notes, and chords. Among persons with congenital defects in perception of music (composing 2 to 4 percent of the population), some 30 percent also suffer disability in pitch contour, a property shared in parallel manner with speech.

Altogether, there is reason to believe that music is a newcomer in human evolution. It might well have arisen as a spin-off of speech. Yet, to assume that much is not also to conclude that music is merely a cultural elaboration of speech. It has at least one feature not shared with speech—beat, which in addition can be synchronized from song to dance.

It is tempting to think that the neural processing of language served a preadaptation to music, and that once music originated it proved sufficiently advantageous to acquire its own genetic predisposition. This is a subject that will greatly reward deeper additional research, including the synthesis of elements from anthropology, psychology, neuroscience, and evolutionary biology. ▽

E.O. Wilson is Pellegrino University Professor emeritus.