

PART III: THE HUMAN MIND

CHAPTER 9

THE EVOLUTION OF BODY, BRAIN, BEHAVIOR, CULTURE, AND MENTALITY FROM THE PALEOLITHIC TO THE NEOLITHIC

Emergence of Reflective Consciousness

9.1	The Idea of Man's Cultural and Mental Evolution: A Brief History.....	530
9.1.1.	Early Ideas of Human Cultural and Mental Evolution	530
9.1.2.	The Anthropological Theory of Culture, and Stages of Cultural Evolution	531
9.1.3.	The Multidisciplinary Approach to the Study of Prehistoric Cultural and Mental Evolution	533
9.2.	Cranial and Skeletal Evolution from Hominoid Apes to <i>Homo sapiens</i> : The Paleontological Evidence	535
9.2.1.	From Apes to the Evolving Hominoids	535
9.2.2.	The Evolution of Hominids: The Early Australopithecines	537
9.2.3.	The Evolution of Hominins: <i>Homo habilis</i> and <i>Homo erectus</i>	540
9.2.4.	The Evolution of Humans: The Robust and Gracile <i>Homo sapiens</i>	541
9.3.	Cultural Evolution from the Early Paleolithic to the Neolithic: The Archeological Evidence.....	552
9.3.1.	Cultural Evolution Reflected by the Succession of Improved Stone Tool Industries	552
9.3.2.	Early Paleolithic Cultures: The Production of Simple Oldowan Tools	553
9.3.3.	Middle Paleolithic Cultures: The Manufacture of Advanced Acheulean and Mousterian Tools	554
9.3.4.	Late Paleolithic Cultures: The Production of Special Purpose Tools	558
9.3.5.	The Mesolithic Transition: Decimation of the Megafauna and Establishing Settlements	560
9.3.6.	The Neolithic Revolution: Building Permanent Villages and Domesticating Plants and Animals	561
9.3.7.	Archeological Evidence for the Evolution of Art	567
9.3.8.	Archeological Evidence for the Evolution of Religion and Morality	571

9.4. The Cultural and Mental Evolution of Hominids and Hominins: An Interpretation Based on the Material Evidence.....	576
9.4.1. Stages in the Mental Evolution of Animals Relevant to Man's Ancestry	576
9.4.2. Hominid and Hominin Evolution: A Recapitulation of the Paleontological and Archeological Evidence	577
9.4.3. Hominid Cultural and Mental Evolution: The Early and Late Australopithecines.....	578
9.4.4. Hominin Cultural and Mental Evolution: <i>Homo erectus</i> and <i>Homo Heidelbergensis</i>	583
9.5. The Contributions of Anthropology to our Understanding of Human Cultural and Mental Evolution	588
9.5.1. The Anthropological Perspective on Human Mental Evolution	588
9.5.2. Culture and Mental Development: The Role of Institutions, Conventions, and the Social Order	588
9.5.3. Ethnological Descriptions of Societies Analogous to the Upper Paleolithic and the Mesolithic	593
9.5.4. Ethnological Descriptions of Societies Analogous to the Neolithic	599
9.6. The Cultural and Mental Evolution of <i>Homo sapiens</i> : A Synthesis of the Archeological and Anthropological Evidence	604
9.6.1. Cultural Evolution of <i>Homo sapiens</i> from the Late Paleolithic to the Neolithic	604
9.6.2. Mental Evolution of <i>Homo sapiens</i> from the Late Paleolithic to the Neolithic	618
9.6.3. The Emergence of Reflective Consciousness	625
9.6.4. Our Paleolithic and Neolithic Legacies	626

9.1. The Idea of Man's Cultural and Mental Evolution: A Brief History

9.1.1. Early Ideas of Human Cultural and Mental Evolution. Cultural and mental evolution is a relatively recent idea. The prevalent ancient belief was that man's past is a record of regression or degeneration. An example is Hesiod's (8th century BCE) fanciful account of the prehistory of the Greek people. In his *Works and Days*, Hesiod (1978) described five ages ("races") in Greek history—beginning with "Lost Paradise under Knossos," followed by Gold, Silver, Bronze and Iron Ages—implying a cultural decline from earlier ages. Regress rather than progress was also the gist of the Biblical myth of human origins. Having been created in the image of God, the first human, Adam, led a blissful life in the Garden of Eden, but after he succumbed to temptation and sinned, his progeny were born wicked and needed divine grace to be saved. This view of human degeneration persisted throughout the Middle Ages and beyond. In his *Scienza Nuova*, originally published in 1725, Vico (1961) described three periods in mankind's history: the age when the gods ruled, the age when heroes were the masters, and his own age. However, Vico no longer viewed this historic succession as degeneration but rather as the progressive liberation of mankind: from the tyranny of gods (theocracy), from the rule of heroes (aristocracy), to the governing of society by reasonable princes. The idea of human progress became the guiding principle of the French Enlightenment. Based on an interpretation of human history, as it was then known, Turgot proposed in his *Progrès Successifs de L'esprit Humain*, published in 1750, that mankind advanced from predominantly irrational barbarism to predominantly rational civilization. A similar idea of mankind's cultural evolution, with many more stages, was sketched later by Condorcet in his *Esquisse d'un Tableau Historique des Progrès de l'esprit Humain*, published in 1795 (Condorcet, 1955; Goodell, 1994).

These early ideas of cultural and mental evolution were elaborated and systematized in the 19th century by Comte (1851-1854). Comte described three stages in the historic evolution of mankind: the theological (or fictitious), the metaphysical (or rational), and the positive (or scientific). (i) The theological stage referred to early times when men believed in supernatural powers and uncritically accepted myths and legends as truths. Comte distinguished three successive phases in this theological stage: fetishism, polytheism, and monotheism. (ii) The metaphysical phase referred to the emergence of rational thinking, beginning with the ancient Greek philosophers who questioned the validity of popular myths and legends and formulated naturalistic hypotheses of what goes on in the world we live in. (iii) The positive stage referred to the emerging new scientific age, as physicists, chemists, and biologists were beginning to use observation and experimentation to formulate the laws that govern natural phenomena. Thomsen (1848) offered the first empirical theory of human evolution. To classify an extensive North European archeological collection available to him, Thomsen proposed three stages in the technical advancement of mankind: the Stone Age, the Bronze Age, and the Iron Age. Lyell (1863) and other geologists garnered evidence that some Stone Age people were contemporaries of extinct animals, establishing the idea of man's great antiquity. Combining the available archeological evidence with anthropological observations, Lubbock (1865) divided the Stone Age into two periods: the Paleolithic and the Neolithic. The Paleolithic period was characterized by stone artifacts without pottery, probably the culture of nomadic hunters and gatherers. The Neolithic period was characterized by abundant ceramic remains, probably the culture of sedentary villagers. Westropp (1872) coined the term Mesolithic, which he thought

was a period between the Paleolithic and the Neolithic. Based on the different workmanship of stone tools that were unearthed from older or younger geological strata, archeologists subsequently divided the Paleolithic age with progressively improved stone flaking techniques into Early (Lower), Middle, and Late (Upper) periods, and identified the Neolithic with the manufacture of polished stone tools.

9.1.2. *The Anthropological Theory of Culture, and Stages of Cultural Evolution.*

This new way of thinking began when seafarers, naturalists, and colonizers discovered that nomadic hunters and sedentary farmers in Africa, America, Australia, and some Pacific islands were less developed industrially and socially than themselves. Those observations led to the anthropological theory of man's cultural diversity and of successive stages in cultural evolution.

THE CONCEPT OF CULTURE. Anthropologists use the term "culture" in a different sense than it is used in everyday discourse (Benedict, 1934; Linton, 1936; Boas, 1938; Malinowski, 1944; Herskovits, 1948; Kroeber and Kluckhohn, 1952; White, 1959). In daily usage, a person is called "cultured" if he is educated and refined, as opposed to being ignorant and boorish. A town is considered "cultured" if it has good educational institutions, fine architecture, and high quality social amenities. This value-laden usage has been changed by anthropologists to an objective one by defining culture as the aggregate of traits that characterize a human community or society, irrespective whether it is primitive or advanced, violent or peaceful, languishing or thriving. The various human societies that anthropologists investigated before their life-style was drastically changed by Western influences shared a set of cultural institutions but with different traits. They all communicated with one another by a grammatical language but used different words; they all produced and used tools, utensils, and weapons but with different techniques; built shelters to protect themselves against the elements in different ways; had social institutions, such as marriage, with a different system of a kinship relations; all of them had an aesthetic system, such as adorning themselves and producing art works in a particular style; and all had a traditionally sanctified moral code that prescribed what is right and wrong, and religious beliefs, rituals, legends and myths that differed from one culture to the next.

THE THEORY OF STAGES OF CULTURAL EVOLUTION. Anthropologists of the late 19th century argued that, using objective criteria, the cultures they explored could be classified in terms of evolutionary stages. The criteria included the workmanship of the tools and weapons produced and used; the size of social units and the complexity of the political organization; the differentiation of the economic system; the corpus of a group's empirical knowledge; and the degree to which they have abandoned myths, superstition and magic, replacing them with critical thinking and reliance on empirical evidence. Using such criteria, Tylor (1871) and Morgan (1877) proposed that mankind has progressed through successive stages of savagery, barbarism, and civilization. The ill-chosen term "savagery" referred to the life style of peoples who lived in small groups as hunters and gatherers. Examples are the Aborigines of Australia who lived in virtual isolation from the rest of the world for about 50-40 k. years (Spencer and Gillen, 1927); the San Bushmen of the Kalahari Desert (Schapera, 1930; Lee, 1979); and the natives of the Andaman Islands (Radcliffe-Brown, 1933). Members of these societies used simple tools and weapons made of wood, bone, and stone, shared the land they roamed over, and possessed only portable property. The ill-chosen term "barbarism" referred to the life style

of farmers who led a more sedentary life style in hamlets and small villages, cultivating small plots of land and raising domestic animals. Examples are the Pueblo Hopis, Zunis, and other Indian farming populations (Boas, 1911; Murdock, 1934), and inhabitants of the Pacific Islands and New Guinea (Malinowski, 1935). These villagers built substantial dwellings, owned property, such as land and livestock, produced improved stone tools, baskets and pottery, and had a rich communal life. “Civilization” was the most advanced stage of cultural evolution. Civilized people live in towns and cities, use metals as tools and weapons, have a stratified social organization and an occupationally diversified economic system, and a political system with a permanent government run by a literate bureaucracy.

RACIAL AND DEVELOPMENTAL THEORIES OF CULTURAL EVOLUTION. The anthropologists of the 19th century struggled with the question whether these stages in cultural and mental evolution are attributable to inborn racial differences or to acquired cultural traits. Morgan wrote about the “inferiority of savage man in the mental and moral scale, undeveloped, inexperienced,” and he characterized civilized man as having the “same brain grown older and larger with the experience of the ages” (Morgan, 1877 [1964, pp. 42, 59]). In contrast, Bastian argued for the “psychic unity of mankind” (Koepping, 1983). In general, the belief was widespread that the darker-skinned natives of Africa, Australia and the Americas lacked the emotional refinement and intelligence of the paler-skinned people of European origins. That idea justified the subjugation and exploitation of the natives by colonists and slave holders. However, the critical assessment of the abilities and potential of these preliterate peoples by anthropologists of the early 20th century lent support to the widely accepted current view that the major difference between the life style and mental abilities of primitive and civilized peoples is not due to inborn racial differences but to differences in economic, social, and cultural development (Linton, 1936; Boas, 1938; Harris, 1964).

IS CULTURAL EVOLUTION A LINEAR PROCESS? The anthropologists of the 19th century also debated whether or not the identified progressive stages in cultural evolution followed a unilinear sequence, akin to the biological evolution among vertebrates from fish to amphibians, reptiles to mammals. Tylor wrote affirmatively: “The institutions of men... succeed each other in series substantially uniform over the globe, independent of what seem the comparatively superficial differences of race and language” (quoted from Harris, 1964, p. 172). Indeed, some aspects of human culture, particularly the technological, reveal a linear progression. For instance, White (1959) has cogently argued recently that the per capita energy production—hence the quantity of goods available to enhance man’s survival needs—has climbed steadily from Stone Age societies to ours. Hunters and gatherers depend on their own muscle power to meet their subsistence needs, gaining some added energy by using simple tools to dig for roots and simple weapons to hunt small animals. Improved weapons, such as the bow and arrow used by large game hunters, added to the efficiency of human muscle action. Harnessing the strength and speed of a horse gave the hunter and warrior a new energy resource. Using the power of an ox or donkey to pull a wheeled cart laden with goods and harnessing the energy of the wind to use a sailboat to carry merchandize from one harbor to the next, further enriched human survival needs by adding external physical energy resources to animate muscle power. And, finally, the use of fossil fuels, steam, electric power, and more recently of novel ways of exploiting physical resources, have further increased the amount of energy available to

mankind. However, in many other cultural domains, the ethnological and historical evidence does not support a strict unilinear evolution. While in some culture areas an overall sequence from nomadic hunting and gathering, to sedentary farming and husbandry, to building of cities and increasing industrialization is evident (Childe, 1936, 1952; White, 1959), history indicates that many advanced civilizations have disintegrated. Several of those that have persisted had periodic growth spurts followed by stagnation and reversals rather than a straight upward trajectory (Kroeber, 1969). Several civilizations of the Mideast, like Sumer, Babylonia, and Assyria have disappeared. The Roman Empire, for instance, disintegrated into decentralized feudal baronies during the Dark Ages. Conversely, we are witnessing now the ongoing transformation of some primitive societies, catapulting them from Stone Age “barbarism” directly into advanced civilizations.

9.1.3. The Multidisciplinary Approach to the Study of Prehistoric Cultural and Mental Evolution. At the same time that anthropologists studied the life style, social organization and cultural traits of primitive peoples in order to reconstruct man’s cultural and mental evolution, paleontologists and archeologists accumulated evidence for biological and technological evolution through the ages, spanning several million years. Paleontologists obtained evidence for a continuity between subhuman primates and humans in terms of skeletal changes and the progressive expansion of the skull (growth of the brain) from apelike humans, early humans, to modern man. And archeologists garnered growing evidence for technological evolution through the ages, as indicated by the production of improved stone implements and other artifacts through successive epochs of the Stone Age.

The Theory of Man’s Descent from Apes. Darwin (1871) and Huxley (1863), arguing for an evolutionary continuity between animals and humans, speculated that a line of African apes gave rise to early man. The first evidence to support this hypothesis was provided by Dart (1925) who described the skull of a “man-ape” child, found in a lime quarry in the Cape Province of South Africa. The child’s teeth showed similarities with that of humans but its brain size was estimated to be in the range of apes. The fossil was assigned to a genus called *Australopithecus*. The recent recognition of close anatomical, immunochemical and genetic affinities between African chimpanzees and humans (Sarich and Cronin, 1966; Ayala et al., 1994; Ruvolo et al., 1994) gave rise to the widely held view that man descended from a knuckle-walking, chimpanzee-like ancestor about 5-7 million years ago (m.y.a.) who, abandoning the arboreal lifestyle of apes, became adapted to terrestrial living in open woody terrains and grasslands. The most significant evolutionary transformations assumed to have taken place in this process were the following. First, the brain, in particular the neocortex, became larger and more complex, providing the early humans with enhanced cognitive powers and the ability to use language to communicate. Second, the skeletomuscular system became fully adapted to bipedal locomotion, freeing the forelimbs to produce, manipulate, and carry tools and weapons. Third, the production of improved tools and weapons allowed these early humans to become large-game hunters, and in time become the masters of this globe. However, the assessment of some recently unearthed fossils suggests that the sequence of transformations was somewhat different. We are apparently not descended from a knuckle-walking ape but a *bipedal hominoid* ape whose brain was not much larger than that of the chimpanzee. In this view, the last common ancestor of chimpanzees and humans was a transitional ape that, as

circumstances required, clambered on trees using four limbs, feeding on fruits and leaves, or ran bipedally on the ground, scavenging for meat and hunting prey. Among the current candidates for that man-ape, or hominoid, are the following: (i) *Orrorin tugenensis* (Senut et al., 2001); (ii) *Sahelanthropus tchadensis* (Brunet et al. 2002); (iii) *Ardipithecus ramidus* (White et al., 2004, 2009; Gibbons, 2009); (iv) and *Ardipithecus kadabba* (Haile-Selassie and WoldGabriel, 2009). These man-apes, living about 7-4.5 m.y.a., are the ancestors of the australopithecines, living about 4 m.y.a. Australopithecines are fully biped hominids with somewhat larger brains (Tobias, 1971; Johanson and Edey, 1981). They were succeeded in time by the larger-brained hominins, *Homo habilis* and *Homo erectus* (Leakey, 1971; Tattersall, 1995); the still larger-brained archaic humans, *Homo heidelbergensis* and *Homo neanderthalis*; and, finally, the surviving modern humans, *Homo sapiens* (Klein, 1999; Stringer and Andrews, 2005). The paleontological evidence of the evolution of human species with ever larger brains (more accurately ever larger skullcaps) was coupled with archeological evidence for progressive improvements in the production of tools, utensils, weapons, and eventually the appearance of ritual and decorative art works (Bordes, 1961; Oakley, 1961; Clark and Piggott, 1965; Binford, 1983; Isaac, 1986).

Multidisciplinary Approach to the Study of Cultural and Mental Evolution. To reconstruct the different aspects of man's somatic, neural, cultural and mental evolution we need a multidisciplinary approach. Accordingly, we begin with a review of the available *paleontological* evidence regarding skeletal transformations and growth in the size of the skullcap from hominoids to modern man. Since cranial capacity provides only a quantitative measure of increase in brain volume, the paleontological approach is supplemented by *neurobiological comparative* qualitative considerations. For example, the relationship between brain volume increases is linked to possible structural and functional diversification of areas in the cerebral cortex. To assess cultural progress, we rely on the *archeological* evidence for the production of improved tools, utensils and weapons, and burial practices and art works from earlier and later geological strata, as determined by modern dating techniques. Archeology does not provide direct evidence about immaterial aspects of cultural evolution, such as the origin and evolution of language, changes in social relations, moral development, and the growth of mythological thinking and magic practices. We therefore supplement the archeological evidence with *anthropological* data to interpret the ecological, economic, social, political and psychological significance of the unearthed artifacts. In the following chapter we will deal with the *prehistorical* and *historical* evidence of technological, political, cultural and mental advances since the invention of record keeping, first impressed into clay or chiseled in stone, later in the form of writing. We will trace the advances in the use of metals and in the exploitation of different energy resources; the change from rural settlements to the organization of city states, nations, and empires; political transformations from the tyranny of theocracies and monarchies to constitutional democracies with greater individual freedom; and the tortuous course of human intellectual growth from imaginative myths to the rigorous application of logical thinking and the scientific method. Finally, as an indirect approach, we will turn to *developmental neurobiology* and *child psychology* to shed some light on the problem of how neural and mental growth might have contributed to the evolution of language and culture. We will argue, first, that the orderly sequence in the maturation of late-developing components of the frontal, temporal and parietal lobes in modern man (neocortical ontogeny)

provides hints about the evolution of the human brain (neocortical phylogeny). Second, that the correlated orderly sequence in the ontogeny of language development, from babbling to uttering single words, to forming long grammatical phrases, allows inferences about the phylogeny of language. Third, that the gradual advance of children from animism and magical thinking to the adoption of logical reasoning and the scientific method parallels the tortuous process of human intellectual evolution.

In this chapter, we first review the paleontological evidence of somatic transformations and cranial expansion from hominoid apes to modern humans, and their possible significance in terms of neocortical growth and differentiation. We then turn to the archeological evidence of progress in the manufacture of tools, weapons and other artifacts and use anthropological data and theories to interpret their significance in terms of man's social, moral, religious, artistic, and intellectual advancement through the ages.

9.2. Cranial and Skeletal Evolution from Hominoid Apes to *Homo sapiens*: The Paleontological Evidence

9.2.1. From Apes to the Evolving Hominoids. Apes are warm-climate, arboreal animals. The continuing cooling of our planet, which caused the tropical forests to recede southward, led to the disappearance of apes in northern Europe and Asia about 12-10 m.y.a., in the Mediterranean coast about 10-8 m.y.a. (Potts, 2004). Then, apes became restricted to the current tropical and subtropical zones of Africa and Asia about 7 m.y.a. As the cooling trend continued and parts of the vast forests turned into drier woodlands and grasslands, a new line of primates, the hominoids, began to evolve in Africa about 6 m.y.a.

The Hominoids: Sahelanthropus, Ardipithecus and Orrorin. The hominoid *Sahelanthropus tchadensis* (Fig. 9-1), nicknamed Toumaï, is known from a nearly complete cranium, mandibular fragments, and a few teeth of one individual discovered in Chad in 2001 (Brunet et al., 2002). More teeth and fossil fragments from other individuals of this species were discovered later (Brunet et al., 2005). The fossils were dated to be about 7 m.y. old. The skull capacity of Toumaï is estimated to be about 360 cc, which is in the range of chimpanzees. However, her skeletal features differed in many respects from chimpanzees, with several human-like features. These included a less protruding muzzle, a shorter skull-base, and the foramen magnum situated somewhat more anteriorly than in chimpanzees (Guy et al., 2005; Zollikofer et al., 2005), suggesting that *Sahelanthropus* walked upright with greater

SKULL OF *SAHELANTHROPUS TCHADENSIS*



Fig. 9-1. Fossilized skull of Toumaï, estimated to be 7 m.y. old, with brain capacity in the range of chimpanzees. (From Talk.origins Archive.)

ease than chimpanzees do. Its ape-sized brain and presumed biped stance are the basis of the hypothesis that *Sahelanthropus* was a transitional species that links pongids (apes) and hominids, i.e., a hominoid.

The fossil of *Ardipithecus ramidus*, originally described by White et al. (1994), was recently analyzed in great detail by a large team of investigators (White et al., 2009; Gibbons, 2009; and several other papers in the same issue of *Science* magazine). *Ardipithecus ramidus*, nicknamed Ardi, lived in Ethiopia about 4.4 m.y.a. The remains consist of much of the skull and most of the teeth (Fig. 9-2), the pelvis, and fragments of the hands and feet. It is estimated that Ardi was about 120 cm tall and weighed about 50 kg, comparable in size to chimpanzees. The cranial capacity was estimated to be in the range of 350 cm³, much like that of chimpanzees (Suwa et al., 2009).

Anatomical features of Ardi's hands indicate that she was not a knuckle walker, and the long and curved spine, and the shape of her pelvic bone suggest biped locomotion (Lovejoy et al., 2009). However, the arms were long relative to the legs, resembling arboreal apes, and the foot is an admixture of pongid and hominid features. Ardi's large lateral toe, much like that of an ape, is well suited to grasp branches when clambering on trees, but the other four toes are forward directed, providing a flat foot for effective upright postural support. More recently, the jaws, teeth, collarbones, arms, hands, and toes of a subspecies of *Ardipithecus*, called *A. ramidus kadabba*, were discovered in Ethiopia (Haile-Selassie and WoldGabriel, 2009). Dated to 5.8–5.6 m.y.a, some skeletal features suggest that these earlier hominoids were biped. Finally, there is also a report of fossil fragments from five individuals found in Kenya, dated to 6.1–5.8 m.y.a. The remains consist of several teeth, jaw fragments, and limb bones, and are attributed to a hominoid species named *Orrorin tugenensis* (Senut et al., 2001). Some features of the femur (leg bone) suggest that these primates were biped (Galik et al., 2004; Richmond and Jungers, 2008).

In summary, there is growing evidence that hominoid apes evolved in central Africa about 6.0–4.5 m.y.a. with facial features and cranial capacity that did not substantially differ from that of chimpanzees (Fig. 9-3) but a skeletal anatomy indicative of upright stance. Presumably these transitional hominoid apes engaged in what might be called *elective bipedalism*, the ability to run on four limbs or on two, as circumstances dictated. This differs from the *mandatory bipedalism* of the true hominid australopithecines, who with their short arms and long legs (which elevate the hindquarters when assuming a quadruped posture), and with fully modified feet, could no longer comfortably run on four limbs.

SKULL OF *ARDIPITHECUS RAMIDUS*

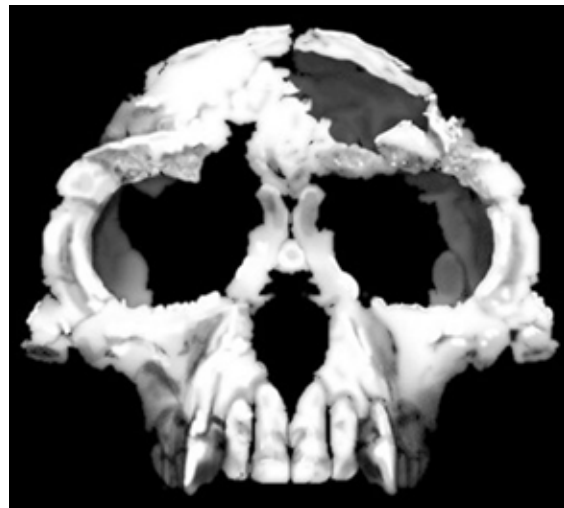


Fig. 9-2. Fossilized skull of Ardi, estimated to be 4.4 m.y. old, with a brain capacity in the range of chimpanzees. (Frim Wikipedia, Ardi.jpg.)

CHIMPANZEE AND HOMINOID SKULLS

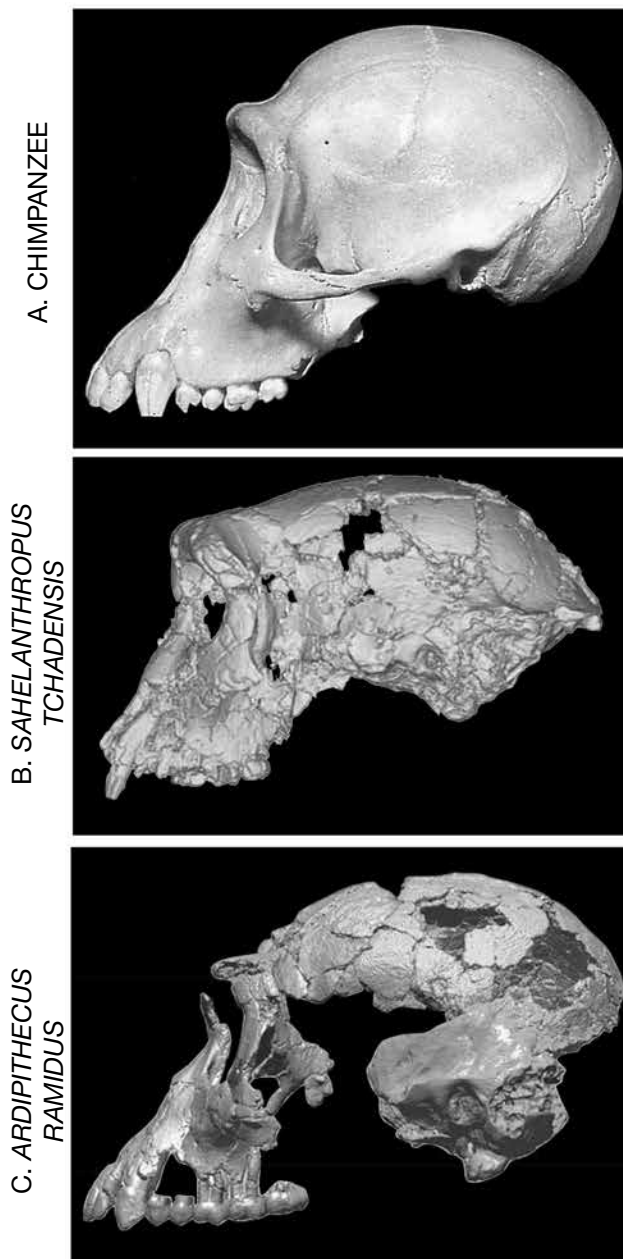


Fig. 9-3. Fossilized skulls of a chimpanzee (A), Toumaï (B), and Ardi (C). (A, from Stringer et al., 2005; B, from Zollikofer et al., 2005; C, from Scienceblogs.com.)

9.2.2. The Evolution of Hominids: The Early Australopithecines.

The early australopithecines (*A. ramidus*, *A. anamensis*, *A. afarensis*) emerged about 4.0 m.y.a. and became extinct about 3.0 m.y.a. (Klein, 1999; Tattersall and Schwartz, 2000; Stringer and Andrews, 2005). Some later evolved species (*A. boisei*, *A. robustus*) survived until about 1.0 m.y.a. A distinction has been made between two hominid genera, the gracile and the robust australopithecines. Some paleontologists refer to that latter as *Paranthropus* and do not consider them to be in the direct line of humans (Martin and Grine, 1988; Fleagle, 1999; Wood and Strait, 2004). The evolution of the australopithecines may have been fostered by a climate change in Africa from warm and wet to cool and dry about 3.4 m.y.a. (Bonnefille, 2004). This climate change became more pronounced about 2.5 m.y.a., with maximum aridity reached about 2.0 m.y.a. (Dupont and Leroy, 1994). By that time, the late australopithecines overlapped with *Homo habilis*, the earliest hominins in a grassland-dominated African ecosystem (Plummer et al., 2009).

BRAINCASE EXPANSION AND MUZZLE REDUCTION IN THE AUSTRALOPITHECINES.

There has been a trend in the australopithecine hominids relative to the hominoids in a small expansion of the braincase, indicative of a growth in brain volume, and smaller teeth, heralding the trend toward the physiognomy of humans (compare Fig. 9-4A; with Fig.

9-2). Estimates indicate a steady increase in the cranial capacity of the australopithecines over the ages. That expansion is illustrated in the comparison of the frontal view of the head of *Australopithecus afarensis* (Fig. 9-4A), who lived about 4.0-3.0 m.y.a., with that of *Australopithecus sediba* (Fig. 9-4B), who lived about 1.8 m.y.a. (Berger et al., 2010). Both of these hominids have cheekbones that protrude laterally relative to the narrow small braincases but matching the size of the orbital and nasal cavities in the two species, it is evident that the braincase of *Australopithecus sediba* has expanded laterally as well as dorsally. We attribute

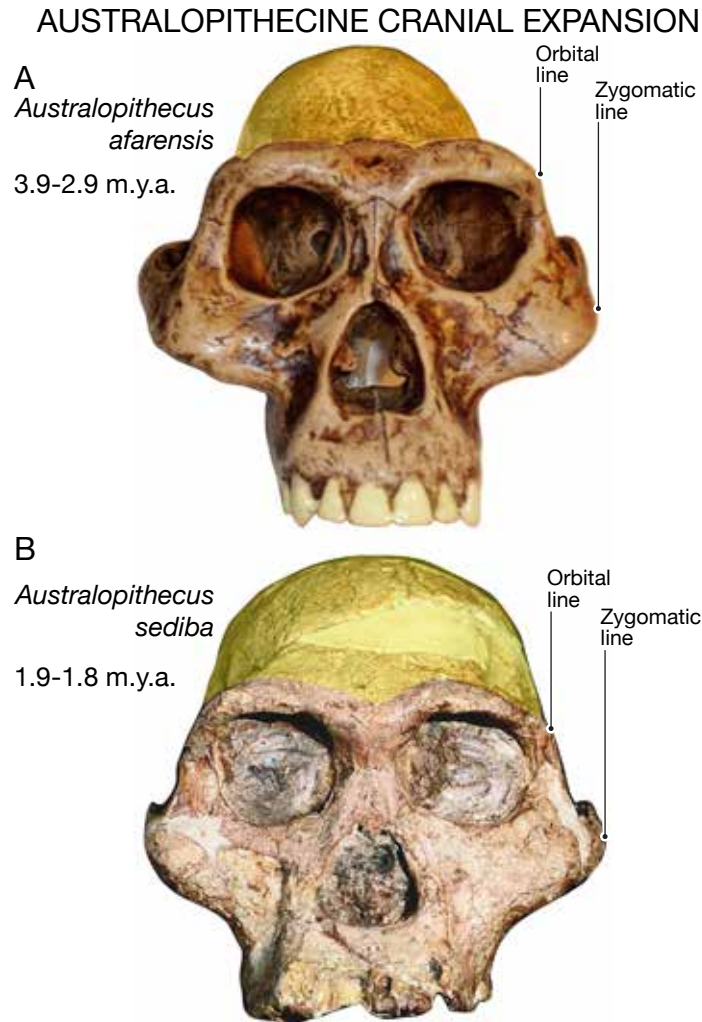


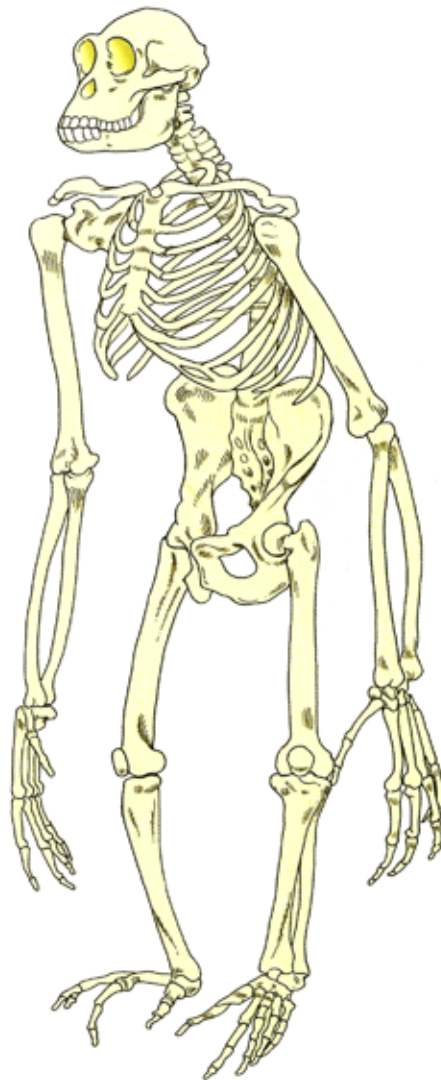
Fig. 9-4. Skulls of an early (**A**) and a late (**B**) australopithecine in frontal view. Note the expansion of the skull dorsally and laterally in the later specimen. (A, from Wikipedia.org; B, from Nationalgeographic.com)

that lateral expansion to the enlargement of the temporal cortex, and the dorsal expansion to the enlargement of the frontal cortex. The estimated brain volume of the early *Australopithecus afarensis* ranged between 380 and 430 cc; that of *Australopithecus garhi* (dated to 2.5 m.y.a.) averaged about 450 cc; *Australopithecus boisei* (2.3-1.4 m.y.a.) 514 cc; and that of *Australopithecus robustus* (1.9-1.4 m.y.a.) 523 cc (Asfaw et al., 1999; McHenry and Coffing, 2000). The overall estimate of 450 cc for the brains of australopithecines (Falk et al., 2000) is modestly larger than the chimpanzees' mean of 395 cc (McHenry, 2000). We will later follow this progressive lateral and dorsal expansion of the cerebral cortex and growth in brain volume from the ancient hominins (*Homo erectus*) to modern humans (*Homo sapiens*).

SKELETAL CHANGES IN THE AUSTRALOPITHECINES. Much of our current knowledge of the postcranial skeletal features of the australopithecines comes from two fossils, the diminutive female, nicknamed Lucy, who lived about 3.2 m.y.a. (Johanson and Edey, 1981), and the much larger male, *Kadanuumuu* ("big boy"), who lived 3.5 m.y.a. (Haile-Selassie et al., 2010). A comparison of the skeleton of a chimpanzee (Fig. 9-5A) and the reconstructed skeleton of *Kadanuumuu* (Fig. 9-5B) indicates that the latter's arms were shorter than that of clambering

SKELETON OF A CHIMPANZEE AND AN AUSTRALPITHECINE

A CHIMPANZEE



B AUSTRALOPITHECUS AFARENSIS



Fig. 9-5. Comparison of the skeleton of a chimpanzee (A) and the late australopithecine known as *Kadanuumuu*. (B). Note the shortening of the latter's arms, the widening of its pelvis with the legs spaced apart, and the flatter feet. (B, from Redorbit.com)

chimpanzees; its pelvis was shaped more like that of bipedal humans but spaced farther apart; and its feet were flatter, less suitable for grasping and better adapted for walking. In general, the fingers and thumb of the australopithecines had the configuration of human hands (Alba et al., 2003; Young, 2003; Drapeau et al., 2005; Almécija et al. 2010), well suited for manipulating and carrying objects, although it is debated whether they walked with a bent-hip and bent-knee gait or with extended hindlimbs as modern humans do (Wang et al., 2003a; Polk, 2004; Raichlen et al. 2008). The preserved Laetoli footprints of a walking adult and a child (dated to about 3.5 m.y.a.) had a pronounced heel strike (Leakey and Hay, 1979; White, 1980) suggesting that the australopithecines were fully bipedal.

THE DIET OF THE AUSTRALOPITHECINES. The fine structure and wear of australopithecine teeth indicate that they were opportunistic omnivores (Kay, 1985; Grine and Martin, 1988; Teaford and Ungar, 2000; Wood and Strait, 2004; Ungar, 2008). And the chemical analysis of the enamel of their teeth suggests that grasses, seeds, and tubers were a major component of their diet (van der Merwe et al., 2003; Laden and Wrangham, 2005; Sponheimer et al., 2005). However, the accumulation of the bones of reptiles, birds, and mammals at their occupation sites suggest considerable meat consumption by some groups (Leakey, 1971). Paradoxically, as the early hominids shifted from primary reliance on the softer nutrients of the forest (fruits and insects typical of chimpanzee diets) to the harder nutrients of the grasslands (seeds, tubers, and meat) there was a reduction in the size of the teeth and jaw. This somatic modification may be due to the transformation of the mouth from a power mechanism to a precision apparatus, either because of its incipient use for speech production and/or the manual processing of hard nutrients before consuming them, perhaps pounding, grinding and pulverizing the cereals and tubers, and cutting, chopping and mincing meat, with sticks and stones. However, there is currently no evidence that the early australopithecines artificially splintered cobblestones with hammers to produce tools with sharp edges. The earliest of such artifacts, identified as Oldowan choppers, appear in deposits dated to about 2.6 m.y.a. (de Heinzelin et al., 1999). These tools may have been produced by the late australopithecines, such as *Australopithecus garhi*, a gracile species with an estimated cranial capacity of 450 cc (Asfaw et al., 1999), or by *Homo habilis*, a hominin species with a larger brain that emerged about that time.

9.2.3. The Evolution of Hominins: *Homo habilis* and *Homo erectus*. The first fossil fragment designated as *Homo*, discovered by Louis Leakey at Olduvai Gorge, has been dated to about 1.75 m.y.a. (Leakey et al., 1964). It was named “handyman” on the assumption that this early human was a toolmaker. A subsequent discovery made by Richard Leakey’s team (Leakey, 1972) at Kooby Fora, Kenya, was a complete cranium (Fig. 9-6A), estimated to have come from a 1.8 m.y. old deposit; according to a current estimate it had a braincase capacity of about 700 cc (Bromage et al., 2008). Several other fossils dated to 2.5 to 1.5 m.y.a., with brain capacity in the range of 600-800 cc, are now provisionally classified as belonging to *Homo habilis* (Wood, 1992; Tattersall, 1995; Lieberman et al., 1996). The relationship of these fossils to the late australopithecines remains uncertain. However, the argument that they were the earliest humans, or hominins, is supported by two facts: they had larger brains than the typical australopithecines (compare Figs. 9-4 and 9-6) and they were contemporaries, as we describe later, of the producers of the Oldowan stone industry.

Unlike the australopithecines and *Homo habilis*, who remained confined to their native tropical and subtropical Africa, *Homo erectus* colonized the temperate zones of the Near East and Far East, and later southern Europe (Antón and Swisher, 2004; Klein, 2005; Lycett, 2009). To do that, as we describe later, required new mental abilities and cultural traditions. Originally discovered in Java by Dubois (1894), *Homo erectus* is believed to have originated in Africa about 1.8 m.y.a. (Leakey, 1976; Brown et al., 1985; Rightmire, 1990; Walker and Leakey, 1993; Tattersall and Schwartz, 2000) but spread from there rapidly to Asia and more slowly to Europe. The earliest *Homo erectus* fossils of Java are dated about 1.8 m.y.a. (Swisher et al., 1994; Larick et al., 2001); of Georgia 1.77 m.y.a. (Gabunia et al., 2000; Vekua et al., 2002; Rightmire et al., 2006); of China, about 1.7 m.y.a. (Zhu et al., 2004, 2008); of Spain about

1.1 m.y.a. (Carbonell et al., 2008); and of England (Roberts and Parfitt, 1999) and Turkey about 0.5 m.y.a. (Kappelman et al. 2008). It is unclear how many regionally diversified species or subspecies belong to the genus of *Homo erectus*. There are thick-walled *Homo erectus* skulls with a prominent supraorbital ridge and those with a less prominent ridge. There are also differences in endocranial volume, ranging from about 700 cc in the case of the Dmanisi skulls of Georgia (Gabunia et al., 2000) to over 1000 cc of the Zhoukoudian skulls of China (Weidenreich, 1943). A newly discovered fossil skull from the region of Lake Turkana in Kenya may be even smaller than those from Dmanisi (Spoor et al., 2007). There are also differences in the body size of *Homo erectus*, ranging from an estimated height of 1.5 meters and weight of about 45 kg of the Danisi fossils (Lordkipanidze et al., 2007) to 1.8 meters and 68 kg of a Turkana fossil (Brown et al., 1958). Among the shared features of virtually all of them is not upright posture, as the name implies (which was a much earlier evolutionary event), but the transverse expansion of the braincase relative to *Homo habilis*.

9.2.4. The Evolution of Humans: The Robust and Gracile *Homo sapiens*. What distinguishes fossil *Homo sapiens* (humans) from *Homo erectus* (hominins) is the expansion of the braincase with a volume approaching or comparable to the brain capacity of modern man, i.e., in the range from 1,100 cc to 1,400 cc. Two species of *Homo sapiens* have been distinguished: a robust one with a thick cranium, a prominent brow ridge, an occipital bun, a receding chin, and a heavy skeleton, and a gracile one with a thinner skull, a receding brow ridge, a protruding chin and a lighter skeleton. The robust humans can be traced farther back in time than the gracile ones, and the latter is the only surviving human species. Hence the two are also distinguished as archaic humans and modern humans (Fig. 9-7).

Robust Archaic Humans and Gracile Modern Humans. A single jaw with a receding chin but human dentition was found in Germany in 1907, and it has been attributed to an archaic human, named *Homo heidelbergensis*. The jaw has recently been dated to about 640 thousand years ago (k.y.a., Hambach, 1996). Robust skulls, classified as belonging to *Homo heidelbergensis*, and dated from 800 to 300 k.y.a. are now known from several sites, including Broken Hill, Bodo, and Lake Ndutu in Africa; Gesher Benot Ya'akov in Israel; Ceprano, Arago, Atapuerca, Petralona (Fig. 9-8A), Steinheim, Swanscombe, and Vértesszöllös in Europe; and Dali in China (Stringer and Andrews, 2005; Mounier, 2009). The estimated braincase volumes range from 1,100 to 1,400 cc (Rightmire, 2004, 2009). *Homo heidelbergensis* was replaced in Eurasia by *Homo neanderthalis* about 300 k.y.a. (Stringer and Gamble, 1993; Mellars, 2004; Stringer and Andrews, 2005; Tattersall, 2006; Hublin, 2009). The Neanderthals became extinct in Europe about 24 k.y.a.

Although it has been proposed that *H. heidelbergensis* was also ancestral to modern *Homo sapiens*, it is more likely that modern humans are descendants of a gracile line without a less prominent brow ridge and a more spherical skullcap, who emerged in Africa about 200-160 k.y.a. (Klein, 1999; Stringer and Andrews, 2005; Tattersall, 2006; Hublin, 2009). The earliest fossils with partial gracile features were found at Ono in Ethiopia and dated to about 195 k.y.a. (McDougall et al., 2005) and at Herto Bouri, dated to about 160 k.y.a. (White et al., 2003). The cranial capacity of the Ono skull is estimated to be about 1,250 cc, the Herto skull, 1,450 cc. By about 125 k.y.a., humans with incipient gracile features became widely

**HOMO HABILIS AND HOMO ERECTUS
CRANIAL EXPANSION**

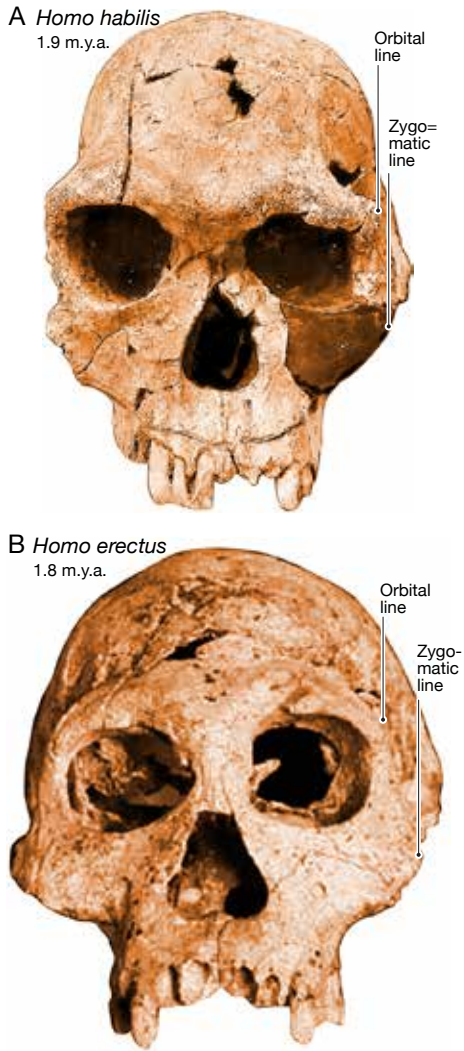


Fig. 9-6. Skulls of *Homo habilis* (A) and *Homo erectus* (B) in frontal view. Note skull expansion, relative to the australopithecines, as illustrated in Fig. 9-4. (A, KNM ER 1813; B, KNM ER 1470)

**HOMO HEIDELBERGENSIS AND MODERN
HOMO SAPIENS CRANIAL EXPANSION**

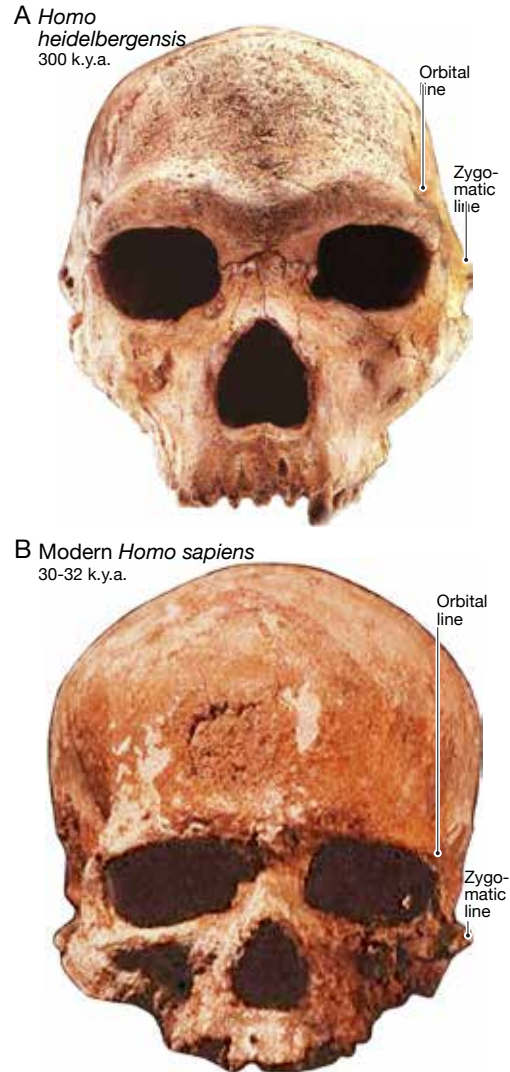


Fig. 9-7. A. Skull of *Homo heidelbergensis* from Petralona, Greece. B. Skull of a modern *Homo sapiens* from Les Eyzies, France.

distributed throughout Africa (Finlayson, 2005) and reached the Levant about 110 k.y.a. (Bar-Yosef, 1995; Valladas et al., 1988) and China (Shen et al., 2002). An anatomically fully modern human skull with a near-vertical forehead, a dome-like skullcap devoid of supraorbital and occipital ridges, small teeth and pointed chin, known as Cro-Magnon man (Fig. 9-8B), was discovered in a rock shelter in France in 1868, together with other skeletal remains, tools and art works. He is estimated to have lived 25 k.y.a. According to recent evidence, fully modern humans reached Australia about 42 k.y.a. (O'Connell and Allen, 2004) and Europe about 40 k.y.a. (Stringer 2002; Trinkaus et al., 2003; Stringer and Andrews, 2005; Holt and Formicola, 2008; Hoffecker, 2009).

SKELETAL DIFFERENCES BETWEEN THE NEANDERTHALS AND MODERN HUMANS. The Neanderthals shared many skeletal traits with modern humans but also retained several archaic features (Springer and Gamble, 1993). Compared with the skeleton of modern humans (Fig. 9-8B), the Neanderthals had a stockier frame, composed of heavy bones, large joint surfaces, and attachment sites for powerful muscles (Fig. 9-8A). The Neanderthals had a larger ribcage than modern humans, one that flares at the bottom (Figs. 9-8C, D) and had a more spacious abdominal cavity (Tattersall, 2006). They also had a wider pelvic girdle which kept the lateral acetabulum (the cup into which the femur's rotating "head" is inserted) spaced farther apart than in modern humans. This, and the horizontal orientation of the femur's "neck," kept the legs vertically aligned in parallel and far apart, rather than converging, which made the Neanderthals slower runners.

A comparison of their pelvic girdles suggests that the Neanderthal females had a wider birth canal than modern human females do, and that could have had momentous consequences for the following reason. The progressive expansion of the brain from hominins to humans led to a serious reproductive problem because the size of the pelvic aperture determines at what developmental stage the fetus must be delivered to allow the head to pass through the birth canal. Apes with relatively small heads can deliver their offspring at a relatively late stage of brain maturation. That is advantageous for both mother and young because the newborn comes equipped with some sensorimotor control, such as the ability to hang on to the mother's fur as she moves about.

NEANDERTHAL AND MODERN HUMAN SKELETON

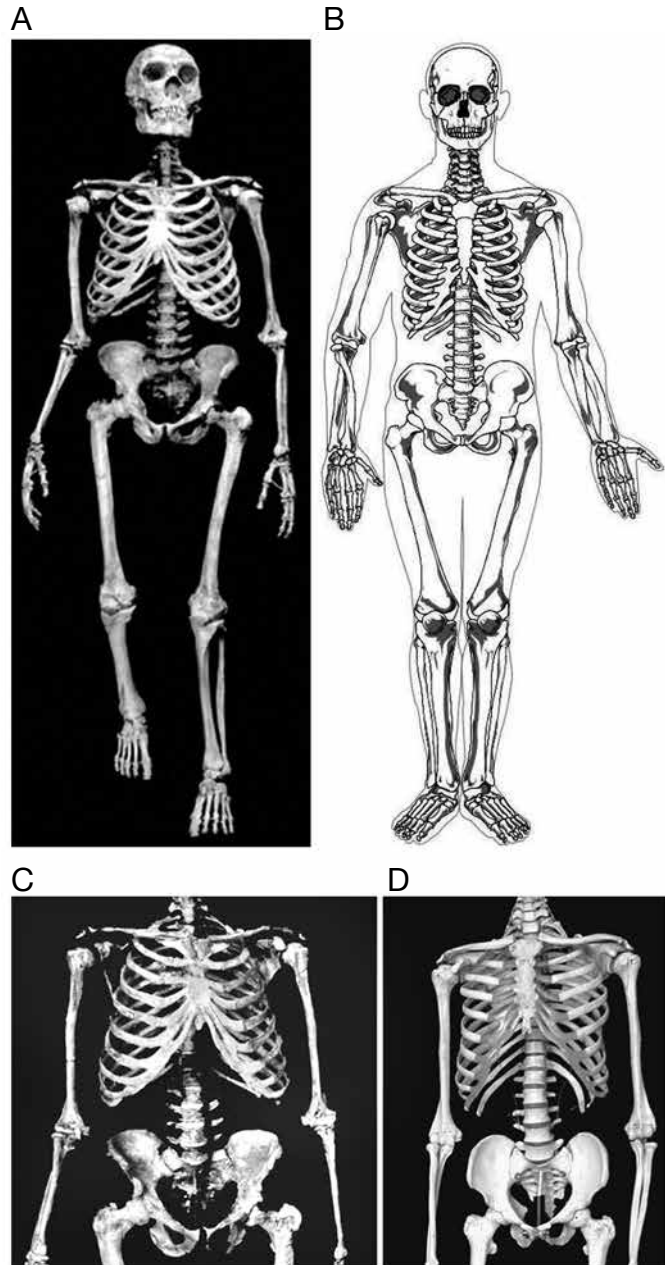


Fig. 9-8. Skeleton of a Neanderthal (A) and a modern human (B). C and D, comparison of the rib cage and the pelvis in the two species. Narrowing of the pelvis and leg anatomy suggest that the Neanderthals were less efficient runners. (After Tattersall, 2006)

As modern humans are destined to develop a much larger head, parturition has to occur at an earlier developmental stage. Indeed, the neonate is delivered before the myelination of the forebrain begins (Bayer and Altman, 2002). Since the neocortex is not functional, the newborn is incapable of voluntary sensorimotor control (Altman and Bayer, 2001). Burdened to carry the infant, the mother's position in the social order has changed drastically. It has been argued that much like modern females, so also the Neanderthal female had difficulty with parturition: (a) because the brain of her newborn, at an estimated 400 cc, is comparable in size to the brain of modern neonates (Ponce de León et al., 2008); (b) because the reconstructed configuration of the Neanderthal pelvis posed a similar difficulty in letting the newborn pass through the birth canal (Weaver and Hublin, 2009). However, we hypothesize that because Neanderthals had a more expansive pelvic girdle, there was less evolutionary pressure to deliver their offspring prematurely. Instead, Neanderthals could deliver more mature neonates, but possibly with a differently organized neocortex.

CRANIAL DIFFERENCES BETWEEN THE NEANDERTHALS AND MODERN HUMANS. The Neanderthal cranium had prominent brow ridges and a flat skullcap with an occipital bun; and the face has a heavy eye socket and nose, a sturdy mandible, and a receding chin (Fig. 9-9A). The modern human cranium is lighter, lacks a brow ridge and is dome-like in shape (Fig. 9-9B). The heavy Neanderthal mandible suggests a powerful masticatory apparatus rather than a precision instrument for vocal articulation. While the cranial capacity of the Neanderthal skull was comparable to or exceeded that of modern humans, their braincase was elliptical in shape rather

NEANDERTHAL AND MODERN HUMAN NEOCORTEX: A HYPOTHESIS

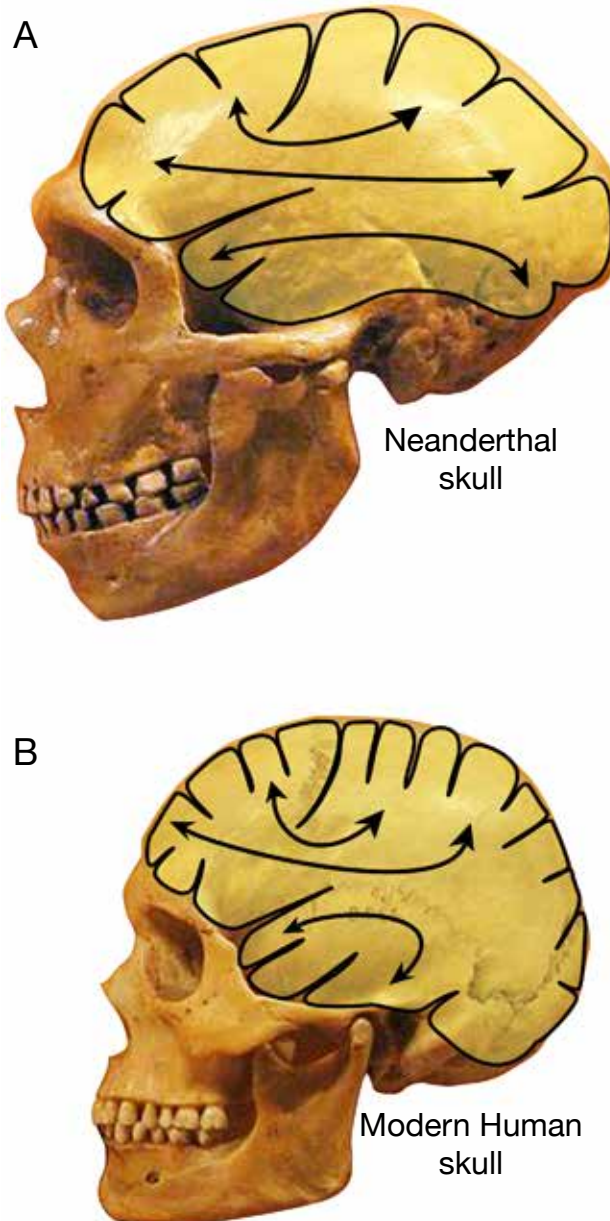


Fig. 9-9. Comparison of the robust head of a Neanderthal (A) and that of a modern human (B). The Neanderthal skull is oval, the modern skull is spherical. The increased foliation of the modern human neocortex, with its shortened fiber tracts, is hypothetical. (Skulls, after Wikipedia: Sapiens neanderthal comparison jpg.)

than spherical as in modern humans. That shape suggests, first, that the Neanderthals may have had less developed frontal and parietal lobes but a larger occipital lobe than modern humans; second, that they had a less compact and less foliated neocortex; third, considering its elongated shape, longer interconnecting associational fiber tracts. If this hypothesis is correct, with their smaller frontal cortex they would have reduced reasoning power, and their longer fiber tracts would have lengthened their sensorimotor reaction time, making them behaviorally more sluggish. As competitors, the robust Neanderthals may have been less intelligent and agile than the Cro-Magnons, and lost out in their struggle for survival.

Cranial Expansion and Neocortical Growth in Human Evolution. While bipedality may have emerged in hominoids as early as 7 m.y.a., reduction of the protruding muzzle lagged by several million years (Figs. 9-10, 9-11).

BRAIN EXPANSION. Cranial capacity directly reflects brain (in particular, forebrain) expansion, and there is evidence for an increase in brain volume from the hominoids to modern humans. That expansion was initially modest but began to accelerate with *Homo habilis* about 2.5 m.y.a. (Fig. 9-12), more than doubling in volume beginning about 1.8 m.y.a. as *Homo erectus* evolved, and more than trebling as *Homo sapiens* emerged.

As noted earlier, the estimated brain volume of *Sahelanthropus* and *Ardipithecus* did not much exceed that of apes. Brain expansion began slowly with the australopithecines (Fig. 9-12, Table 9-1). A current estimate of average australopithecine brain volume is 450 cc (Falk et al., 2000), with a range from 434 cc to 530 cc, and there are indications for an increase in australopithecine brain volume from the early to the late species (McHenry and Coffing, 2000). Beginning with *Homo habilis*, there was a steady expansion in brain volume, and that growth accelerated in *Homo erectus* and *Homo sapiens* (McHenry, 1994, 2000; Holloway, 1999; Rightmire, 2004; Neill, 2007). The body weight of *Homo habilis* (males 52 kg, females 32 kg) was only slightly larger than that of the australopithecines (and about the same as chimpanzees), but their brain volume increased to an estimated average of over 600 cc, and a range up to 800 cc (McHenry, 2000). The averaged brain size of 30 *Homo erectus* specimens, collated by Rightmire (2004), is 972 cc, which is over a double of the average for australopithecines (450 cc). Dichotomizing the 30 specimens listed by Rightmire into those with an estimated geological age of 1.0 m.y. or older (n=14), and those with an estimated age of 850 k.y. or younger (n=16), gives an average of 895 cc for the earlier *Homo erectus* fossils, and 1,041 cc for the later *Homo erectus* specimens. The brain volume of archaic *Homo sapiens* has increased further. The average of 10 specimens listed by Rightmire (2004) is over 1,200 cc. Finally, the expansion of the cerebral cortex reached its zenith with *Homo neanderthalis* and modern *Homo sapiens*, with an average brain volume of 1350 cc; i.e., more than triple that of the australopithecines. On the basis of these differences in cranial volume, mostly attributable to the expansion of the neocortex, we shall identify the early australopithecines as “pithecocephalic,” the late australopithecines and *Homo habilis* as “oligocephalic,” *Homo erectus* as “megacephalic,” and *H. sapiens* as “supracephalic” (Table 9-1). Using neencephalic expansion as the foundation of cognitive growth, we shall look for major advances in cultural evolution in the succession of hominins and humans with ever larger brains, paying less attention to their current identification as genera, species or races.

THE SKULLS OF HOMINIDS AND HOMININS

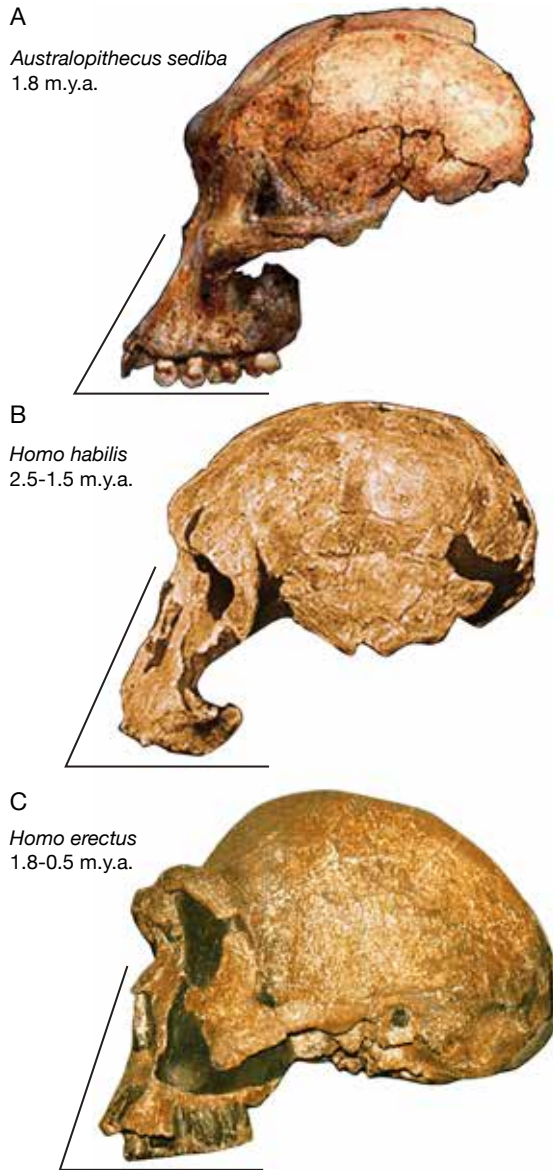


Fig. 9-10. Comparison of the skulls of a late australopithecine (A), *Homo habilis* (B), and *Homo erectus* (C), in lateral view. Note the progressive expansion of the skullcap and flattening of the face.

(A, after Berger, 2010; B, KNM ER 1470; C, KNM ER 373)

THE SKULLS OF ARCHAIC AND MODERN HUMANS

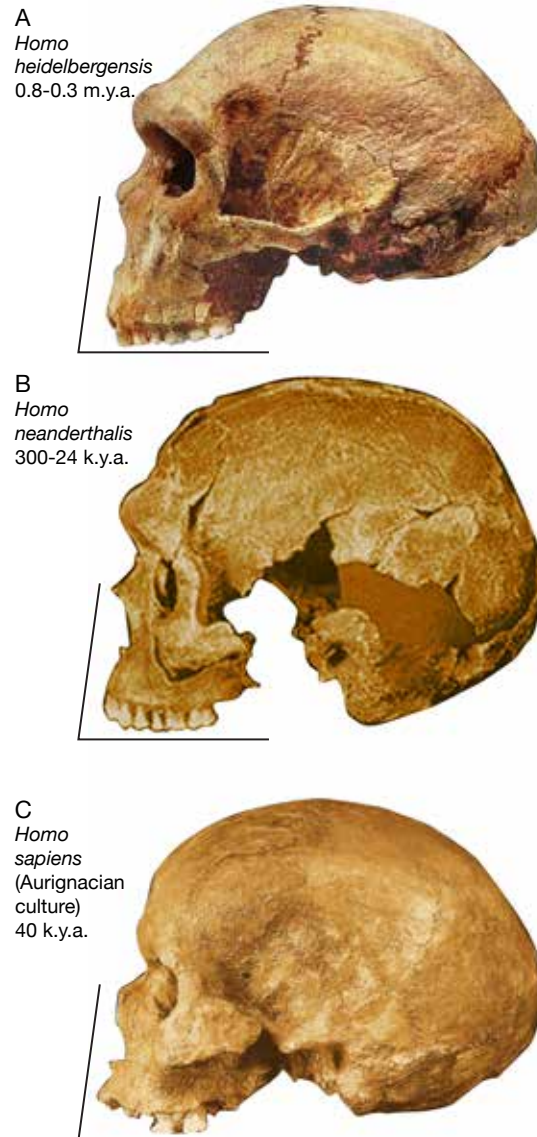


Fig. 9-11. Comparison of the skulls of *Homo heidelbergensis* (A), *Homo neanderthalis* (B), and *Homo sapiens* (C) in lateral view. Note progressive expansion of the skullcap and growth of the forehead.

(A, Petralona, Greece; B, Quafzeh 6, Israel; C, Mladec, Czech Republic)

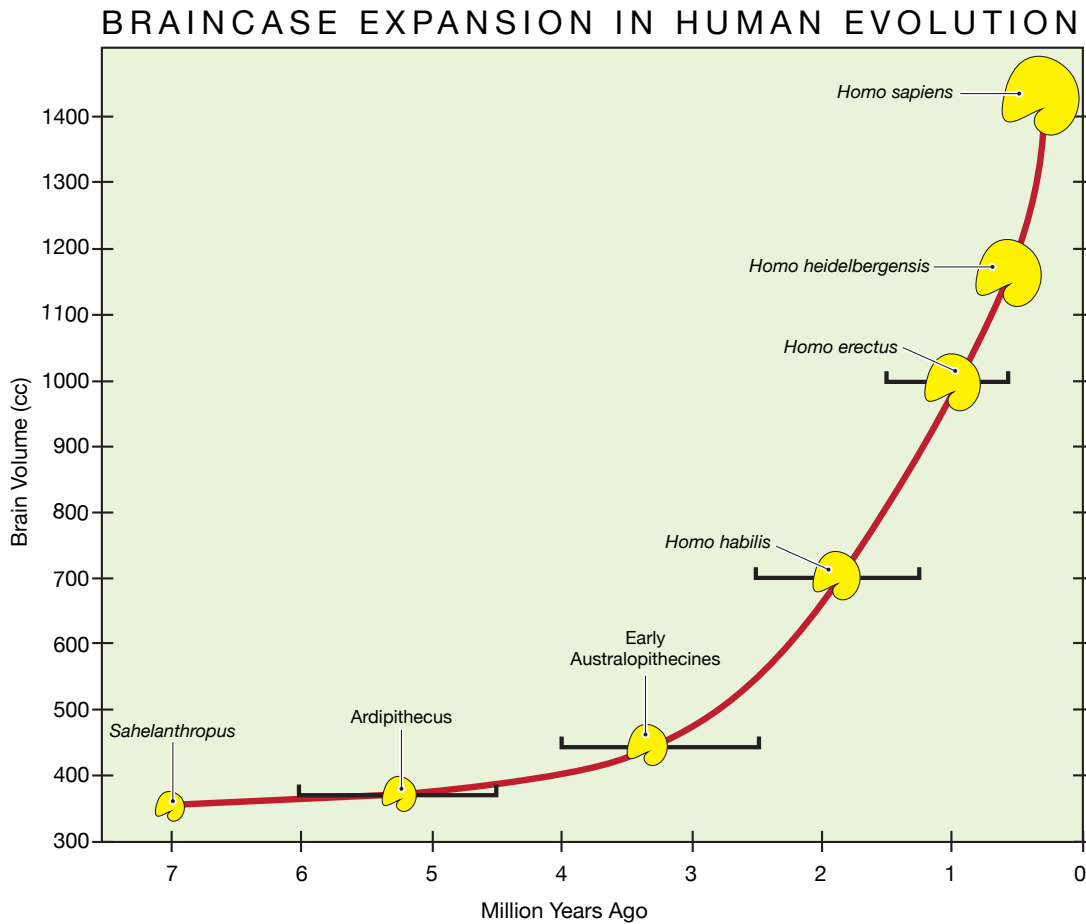


Fig. 9-12. Braincase expansion and estimated increase in brain volume (in cc) from *Sahelanthropus* to *Homo sapiens*.

TABLE 9-1
Brain Expansion from the Australopithecines to Prehistoric Modern Humans

GENUS	BRAIN (cc)	PERIOD (m.y.a.)	CEPHALIC EXPANSION
Early australopithecines	450	4.2-2.0	Pithecocephalic
Late australopithecines (<i>Homo habilis</i>)	500-600	2.6-1.6	Oligocephalic
Hominins (<i>Homo erectus</i>)	700-800	1.8-1.0	Oligocephalic
Robust archaic humans (<i>Homo heidelbergensis</i>)	1000	1.0-0.6	Megacephalic
Robust modern humans (<i>Homo neanderthalis</i>)	1350	0.3-0.03	Supracephalic
Gracile modern humans (<i>Homo sapiens</i>)	1350	0.2-0.01	Supracephalic

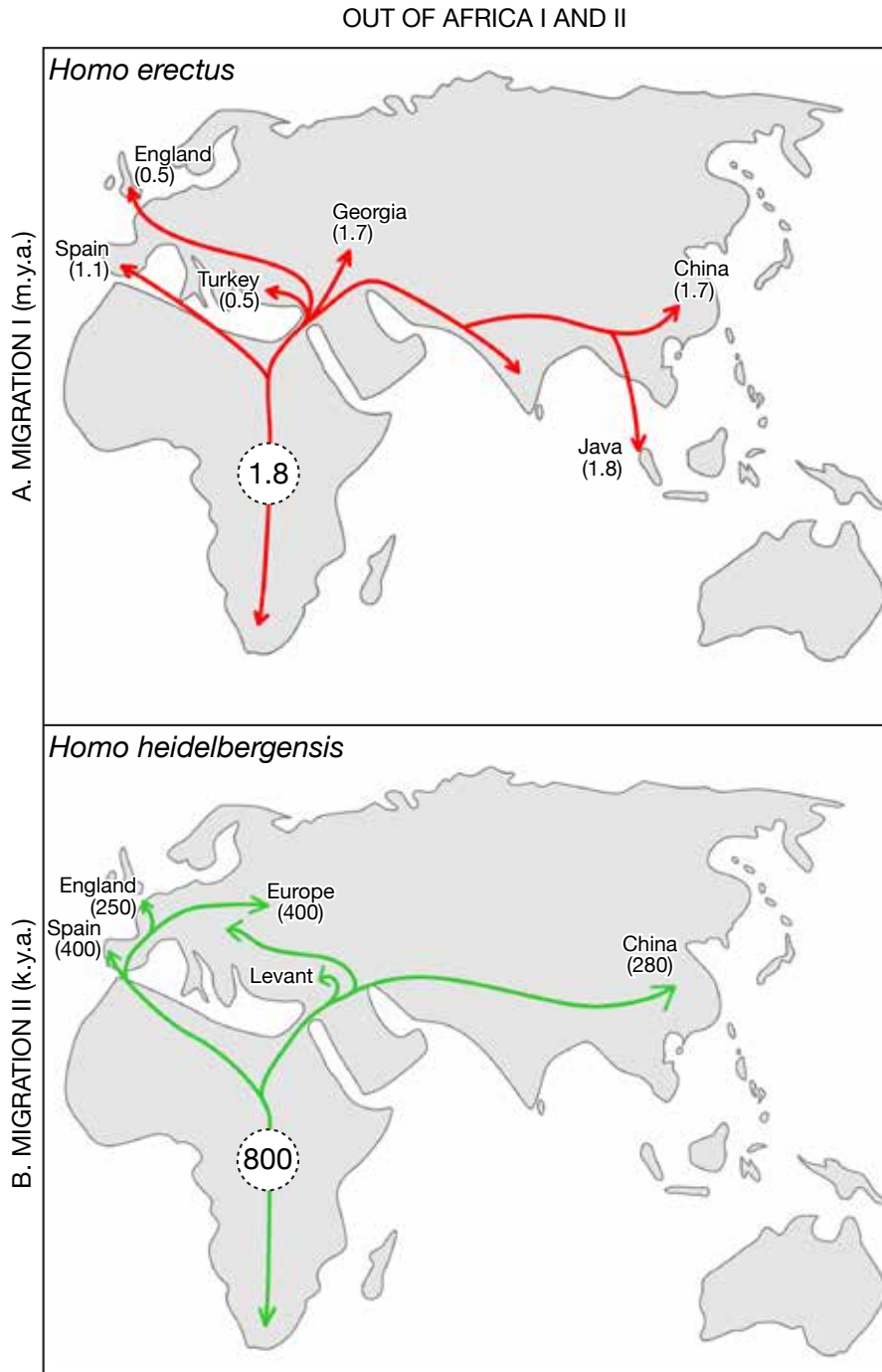


Fig. 9-13. A. Origins in Africa, and presumed migratory route and time of arrival of *Homo erectus* in Asia and Europe (in million years). **B.** Origins in Africa and presumed route and time of arrival of *Homo heidelbergensis* in Asia and Europe (in thousand years).

THE ANCESTRY OF MODERN HOMO SAPIENS. It is well documented that the braincase (and by implication, the brain) has greatly expanded from the australopithecines to modern humans over a period of about 3.5 m.y. (Fig. 9-12). It is also well established that the small-brained australopithecines and *Homo habilis* with a larger brain evolved in and remained confined to Africa. *Homo erectus*, who evolved in Africa about 1.8 m.y.a., was the first hominin able to leave and did so rapidly, reaching Java 1.8 m.y.a, China 1.7 m.y.a., Georgia 1.7 m.y.a., and Spain 1.1 m.y.a. (Fig. 9-13A). This momentous event has been referred to as “Out-of-Africa I”

(Stringer and Andrews, 2005; Klein, 2008). Presumably these early humans with an expanded neocortex could colonize the temperate zones of Asia and Europe because they acquired the ability to turn animal skins into warm clothing, build adequate shelters, and make fire to keep warm during the cold months. The colonization of the colder zones of Europe was mainly the accomplishment of the still larger-brained *Homo heidelbergensis* (Fig. 9-13B). Emerging in Africa about 800 k.y.a., these robust humans colonized southern Europe about 400 k.y.a. and reached England 250 k.y.a. (“Out-of Africa II”). Finally, archaic *Homo sapiens* with a gracile constitution emerged in Africa about 200 k.y.a. and were the ancestors of anatomically modern humans that emerged about 50 k.y.a. Modern humans were able to colonize much of our inhabitable planet (“Out of Africa III”; Fig. 9-14). There is also solid archeological evidence, as we describe below, that humans learned to produce better and better stone tools, beginning with coarsely prepared, all-purpose choppers about 1.6 m.y.a. to finely wrought, task-specific and hafted tools and weapons by 50 k.y.a. However, it remains unresolved whether the succession of different human populations in different regions of the globe was due to: (i) *replacement* of one species by another (Stringer and Andrews, 1988, 2005; Klein, 2008; Tattersall, 2009), (ii) regional *advancement* (Wolpoff, 1999); (iii) different patterns of *interbreeding* in different areas of the globe (Bräuer, 1992; Templeton, 2002). These are not mutually exclusive scenarios. For instance, there is good evidence for the replacement of the robust Neanderthals by gracile humans; some evidence for the advancement of archaic *Homo*

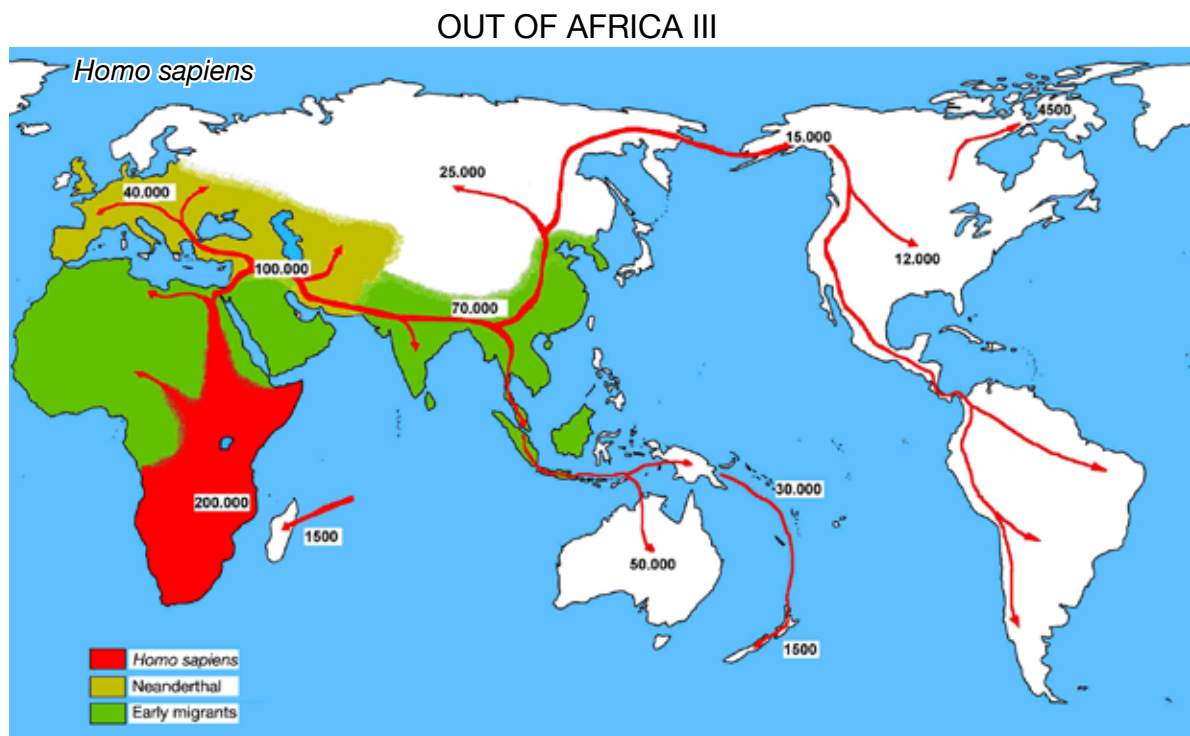


Fig. 9-14. Origins of *Homo sapiens* in southern Africa (red), and their dispersal (red lines) to northern Africa, the Middle East and the Far East (green) and in succession thereafter to all inhabitable areas of the globe (white). The distribution of the Neanderthals shown in yellow. (After Wikipedia: Spreading homo sapiens.jpg)

sapiens into anatomically modern humans; and according to recent genetic studies, appreciable interbreeding between different populations (Mellars, 2006). According to the first hypothesis, groups of large-brained archaic humans that evolved in Africa left the continent to colonize regions in Eurasia and the Far East occupied by *Homo erectus* and replaced them there. Later, *Homo heidelbergensis*, a larger-brained human evolved in Africa, moved into areas occupied by *Homo erectus* and replaced them. According to the second hypothesis, *Homo erectus* evolved independently in different parts of the globe first into archaic humans, and subsequently into the African, Eurasian and Far Eastern races of modern humans. Both hypotheses assume little interbreeding (gene flow) among the different species. However, global replacement and regional continuity are not mutually exclusive scenarios (Bräuer, 1992). It is possible that in response to ecological challenges produced by drastic climatic fluctuations—glacial and interglacial epochs in Eurasia, and changing arid and wet conditions in Africa (Carto et al., 2009)—the small-brained *Homo erectus* populations evolved independently in Africa, Eurasia and the Far East into variants of larger-brained, robust archaic humans. Then, more recently, a more advanced gracile species moved out of Africa and the newcomers interbred to various degrees with the locals to produce the different races of modern humans. Future genetic studies in isolated parts of the globe may resolve this issue.

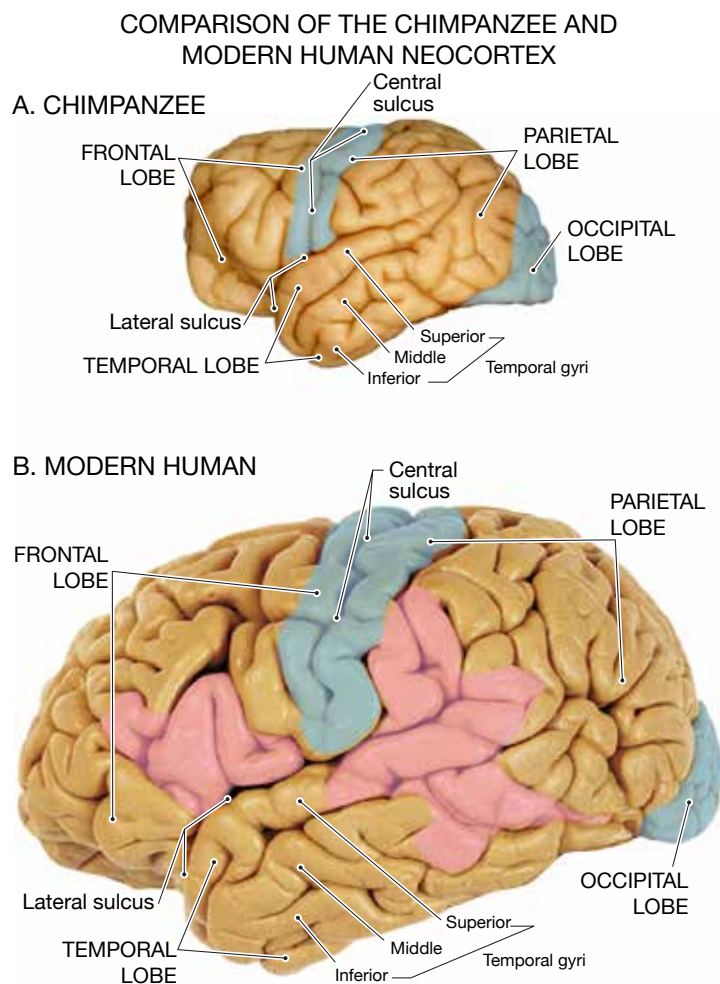


Fig. 9-15. A. Lateral view of the chimpanzee (A) and modern human (B) neocortex, with the motor, tactile and visual projection areas colored blue. Convulsions in the frontal, temporal and parietal association areas in the human neocortex that are not evident in the chimpanzee are colored pink. These areas are implicated in language mediated higher mental functions.

NEOCORTICAL EVOLUTION. Although much of the cranial expansion from the hominoids to modern humans is obviously due to the enlargement of the cerebral cortex, we have little direct information about the specific morphological changes involved. As we noted earlier, a facet of cortical expansion in higher mammals and primates is increased foliation and functional diversification. However, because the dura mater that separates the brain tissue from the skull is a surface covering that does not penetrate into the crevices (sulci) of the cortical convolutions (gyri), the available endocasts of fossil crania tell us little about the changes in cortical foliation that was associated with cortical expansion. As a first approximation to that presumed increase in cortical foliation, we compare a lateral view of a chimpanzee cerebral cortex (assuming that it is closely related to the hominoid neocortex) with a modern human cerebral cortex (Fig. 9-15). It is evident, first, that in the greatly expanded human neocortex, the skeletomotor (precentral) and somesthetic (postcentral) gyri are greatly enlarged (there is no evidence for such enlargement in the occipital visual cortex). Presumably, the expansion of the somesthetic and skeletomotor projection areas is related to the heightened neural processing requirements of increased manual dexterity and upright stance of humans. Second, there are gyri in the frontal, temporal and parietal lobes of the human neocortex that appear to be absent in chimpanzees. These association areas in humans are closely related to the increased cognitive ability to use a language: Broca's area for speech production and Wernicke's area for speech comprehension (Fig. 9-16). We presume that much of the expansion of the cerebral cortex from hominoids to modern humans are attributable to the expansion of these association areas and correlate with the parallel evolution of human culture.

THE LANGUAGE AREAS OF THE HUMAN NEOCORTEX

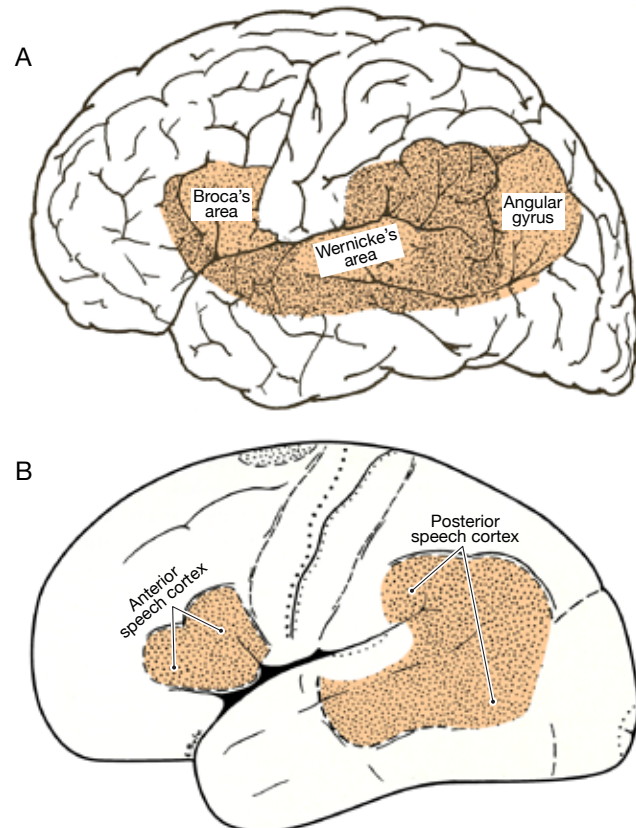


Fig. 9-16. Language areas of the human neocortex, as originally proposed by Dejerine (1914) on the basis of early pathological investigations (A), and by Penfield and Rasmussen (1950) on the basis of brain stimulation studies in conscious subjects (B).

9.3. Cultural Evolution from the Early Paleolithic to the Neolithic: The Archeological Evidence

9.3.1. Cultural Evolution Reflected by the Succession of Improved Stone Tool Industries.

Humans differ from subhuman primates not only by having much larger brains and increased cognitive powers but also by being reared in a culture, becoming assimilated members of that culture, and passing that culture on to succeeding generations. As ethnologists have discovered in the 19th century, all human groups that have been encountered in isolated regions of the planet had a distinctive culture (Murdock, 1934; Clark and Piggott, 1965; White, 1959). This includes the hunter-gatherers that lacked the knowledge how to cultivate the land and raise domestic animals, such as the Aboriginies of Australia (Spencer and Gillen, 1927), the San Bushmen of the Kalahari Desert (Schapera, 1930; Lee, 1979), and the natives of the Andaman Islands (Radcliffe-Brown, 1933). Members of these cultures communicated with one another by means of a grammatical language; produced and used tools, utensils, and weapons; built shelters for protection against the elements; had social institutions, such as marriage and a kinship system; a moral code, such as the incest taboo and rules regulating their marital and sexual relations; conventional rules how to educate and train their young; an aesthetic system, such as adorning themselves in a particular way and producing works of art; religious beliefs, rites and rituals, legends and myths; and, last but not least, they all had a time-tested corpus of practical knowledge how to survive and prosper in the habitat they occupied. Notably, however, all these “savages” or “primitive” peoples (as they were known) were anatomically modern humans; hence they cannot be construed to represent man’s cultural evolution before the emergence of *Homo sapiens*. To do that we have to turn to archeology and follow man’s cultural evolution beginning with the small-brained australopithecines. But that takes us back to several million years before the present and is fraught with serious problems. First, only hardy materials were preserved through the ages, principally stone tools and weapons. Second, things made of wood, hides, fibers, and the like, have perished. Hence our archeology-based stages of cultural evolution have come to be known as the Lower, Middle and Upper Paleolithic periods. Our task is to use the available lithic remains to reconstruct the culture of these early societies and the mentality of the people who created and sustained these cultures.

The Eolithic: The Period Without Evidence of Tool Fabrication. We have currently no evidence for the preparation of stone artifacts by percussion or flaking until about 2.6 m.y.a. Hence, the early australopithecines cannot be credited with the ability of manufacturing stone tools and weapons. However, since we know that chimpanzees use unmodified sticks and stones to crack nuts, and often carry them for short distances from one site to another, we can assume that the early australopithecines did use natural objects as tools and weapons. Indeed, it is a reasonable hypothesis that the evolution of upright stance was driven by the advantages bestowed by the ability to carry tools and weapons with the freed hands. Living in the open grasslands, the use of modified sticks as clubs and round stones as projectiles would have been particularly advantageous to drive off ferocious and far more powerful feline and canine predators. But why did the early australopithecines fail to develop the knowhow to fabricate stone tools and weapons over the long period that elapsed between 4.0 to 2.6 m.y.a.? This may have been due to several shortcomings. First, the brain of the early australopithecines was only slightly larger than that of apes. Like apes, they may have lacked the cognitive

power to spontaneously develop the skill of stone knapping. Second, stones that archeologists readily accept as *bona fide* manufactured tools are the handiwork of trained individuals, but the australopithecines may have lacked the social stratification to produce trained artisans. Third, even if an occasional australopithecine individual did develop the skill to fracture stones to produce tools with sharp cutting edges, and use them to produce spears and clubs, that knowledge would have been difficult to pass on as cultural tradition from one generation to the next in the absence of language.

9.3.2. Early Paleolithic Cultures: The Production of Simple Oldowan Tools. The earliest cache of unmistakable stone tools, together with associated bones having cut marks, were recently excavated from a 2.7 m.y. old site in Ethiopia (Semaw et al., 1997; Semaw et al., 2003; Stout et al., 2010). The artifacts were pebbles and rocks with an irregular splintered surface and sharp cutting edges (Fig. 9-17). Classified as Oldowan choppers, these *unifacial, multi-purpose* implements may have been used to break bones to extract their marrow, soften and mince raw flesh, and pulverize tough roots and seeds. These implements can be produced with a few well-aimed blows by using another hard stone as a hammer (Whiten et al., 2009; Toth and Schick, 2009). The byproducts, the flakes, may have been used as knives to butcher carcasses, as scrapers to clean bone and skin, and as whittling tools to smooth and sharpen digging tools and spears. The producers of this industry were either late australopithecines or the larger-brained *Homo habilis* (Kimura et al., 2002; Sahnouni et al., 2002; de la Torre et al., 2003). At several sites, primitive stone implements were associated with the bones of butchered large mammals that have cut marks (Dominguez-Rodrigo et al., 2005). There were apparently regional differences in the use of these artifacts. For instance, at a site in Kenya, dated to be about 2.3 m.y. old, rocks were used to produce principally flakes, and the cores appeared to be wastes (Roche et al., 1999; Delagnes and Roche, 2005). However, it is unlikely that the Oldowan tools were used as weapons. Spherical and ovoid pebbles abundant along riverbanks, and wooden spears with sharpened points would have been more suitable to hunt prey or as a defense against predators. This primal lithic industry persisted as a cultural tradition for about 1 million years, a phenomenon called the “Oldowan technological stasis.”

AN EARLY OLDOWAN STONE TOOL
FROM ETHIOPIA



Fig. 9-17. A simple, multipurpose stone tool with a single worked face, known as an Oldowan chopper, from a 2.7 m.y. old Ethiopian site. (From Stout et al., 2010)

AN ACHEULEAN HANDAXE
FROM THE OLDUVAI GORGE



Fig. 9-18. A symmetrically flaked, bifacial multifacial tool, known as an Acheulean handaxe, from Olduvai Gorge, dated to about 1.5 m.y.a. (From britishmuseum.org)

9.3.3. Middle Paleolithic Cultures: The Manufacture of Advanced Acheulean and Mousterian Tools. The relatively simple unifacial Oldowan tools were replaced in Africa about 1.7 m.y.a. by more complex tools, known for historic reasons (after a French site) as Acheulean handaxes. The one illustrated in Fig. 9-18 is from an Olduvai Gorge deposit dated to be about 1.5 m.y. old.

THE ACHEULEAN TOOLS. Acheulean tools appeared in Ethiopia about 1.7 m.y.a. (Asfaw et al., 1992); Kenya 1.65 m.y.a. (Roche, 1995; Roche and Kibunija, 1996), or as early as 1.8 m.y.a. (Lepre, 2011); and South Africa 1.6 m.y.a. (Gibbon et al., 2009). Correlated evidence for carcass processing with sharp tools was dated to 1.5 m.y.a. in Kenya (Pobiner et al., 2008). The Acheulean technology reached the Levant (Israel) about 1.4 m.y.a. (Bar-Yosef and Goren-Inbar, 1993); China 1.1 to 0.8 m.y.a. (Hou et al., 2000; Hyodo et al., 2002) or later (Yamei et al., 2000); southern Europe about 900-800 k.y.a. (Carbonell et al., 1999), and northern Europe about 500 k.y.a. (Roebroeks et al., 1992, 2002; Ascenzi et al., 2000). Acheulean multifacial tools are characterized by a uniformity of design with some variations attributable to improvements in their production over the ages, the raw materials used, and regional stylistic differences (Oakley, 1961; Clark, 1977; Isaac, 1984, 1986; Wynn

and Tierson, 1990; Klein, 2000; Lycett and Gowlett, 2008). Some of the earliest multifacial tools were produced by a modified Oldowan technique. A hand axe could be made by delivering several well-aimed strikes on spherical or oval cobbles with a soft hammer leaving the butt of the cobble uncut (Fig. 9-19A). Increasingly, siliceous rocks—flint, chert, obsidian and quartz—which are very hard but can be flaked with perfect conchoidal fracture, became the preferred raw materials for producing hand axes (Fig. 9-19B). These handaxes were relatively bulky and heavy to carry; in time they were replaced by thinner and lighter symmetrically cut bifaces (Fig. 9-19C). The Acheulean tradition endured until about 100 k.y.a.

TECHNICAL ADVANCES IN STONE TOOL PRODUCTION. There are several methods to produce a stone tool (Oakley, 1961; Schick and Toth, 1993). The simple Oldowan tool (Fig. 9-17) is produced by striking one end of a suitably shaped pebble or rock with another rock as a hammer to produce a single wrought surface with sharp edges (Fig. 9-20A). The modified pebble (the core) might have served as an all-purpose chopper and perhaps some of the flakes were used as knives for whittling. The Oldowan technique was invented about 2.7 m.y.a. and it is likely that most adult hominids mastered this skill. The Acheulean technique, which first appeared in Kenya about 1.7 m.y.a., is a more difficult task since it involves a production

VARIETIES OF ACHEULEAN TOOLS

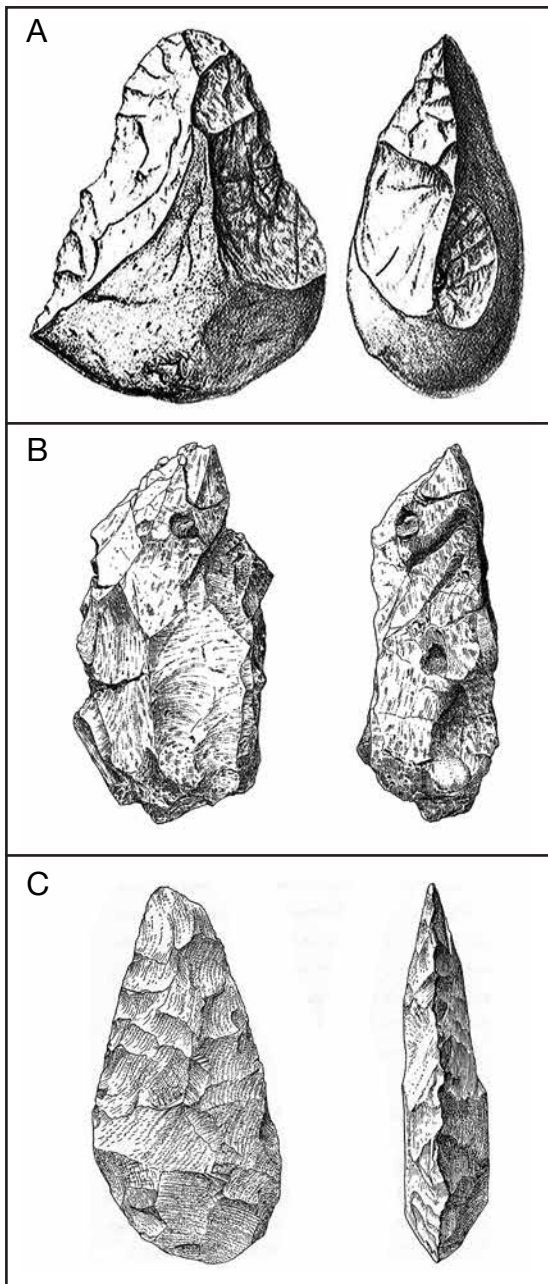


Fig. 9-19. Acheulean bifaces of simpler and finer workmanship from different sites. (A, from Otte, 2010; B, from Carbonell, 1999; C, from Oakley, 1961)

plan and considerable manual skill. An early method was to take a pebble and use several well-aimed strikes with a rock while turning the pebble around (Fig. 9-20B). More advanced Acheulean tools, the symmetrical bifaces that appeared about 500 k.y.a., were produced by striking a pebble or rock with a stone hammer to get its rough shape, then delicately striking it with a soft hammer to give it its trimmed appearance (Fig. 9-20C). These tools may have been produced by *Homo heidelbergensis*, who replaced *Homo erectus* in Africa and Eurasia beginning about 500 k.y.a. (Roebroeks, 2001). A great advance in the production of stone tools was the introduction of the Levallois, or prepared core technique, about 300 k.y.a. Using a hammer and a chisel, a rock was first shaped into a cylindrical blank of a particular height (Fig. 9-20D). In the next step, using a hammer and a chisel, the blank was cut into a large number of similar blades (Fig. 9-20E). Next, the blades were transformed by a knapper into different end products. The last step was pressure flaking; i.e., applying pressure with a fine tool to refine the appearance of a tool or retouch it (Fig. 9-20F). It is generally assumed that the production of Acheulean tools was the handiwork of *Homo erectus*. However, the first appearance of bifaces in China about 1.1 m.y.a. does not coincide with the current evidence of the arrival of *Homo erectus* in China as early as 1.7 m.y.a. (Zhu et al., 2004, 2008). It is possible that the slower spread of this technology was due to delayed cultural diffusion from an original production site. As judged by the remains of the bones of large animals with cut marks associated with his remains, *Homo heidelbergensis* was an effective hunter. He crafted wooden spears about the same period, as

a discovery made in Germany indicates (Thieme, 1997). Undoubtedly, *Homo heidelbergensis* used the hides of the butchered animals for clothing and as shelter coverings.

Among other technical advances during the Middle Paleolithic was the use of fire, dated to about 790 k.y.a. in the Levant (Goren-Inbar et al., 2004; Alperson-Afil et al., 2009). At another site in the same region, dated to about 380 k.y.a., burnt bones with cut marks were

ADVANCES IN STONE TOOL PRODUCTION

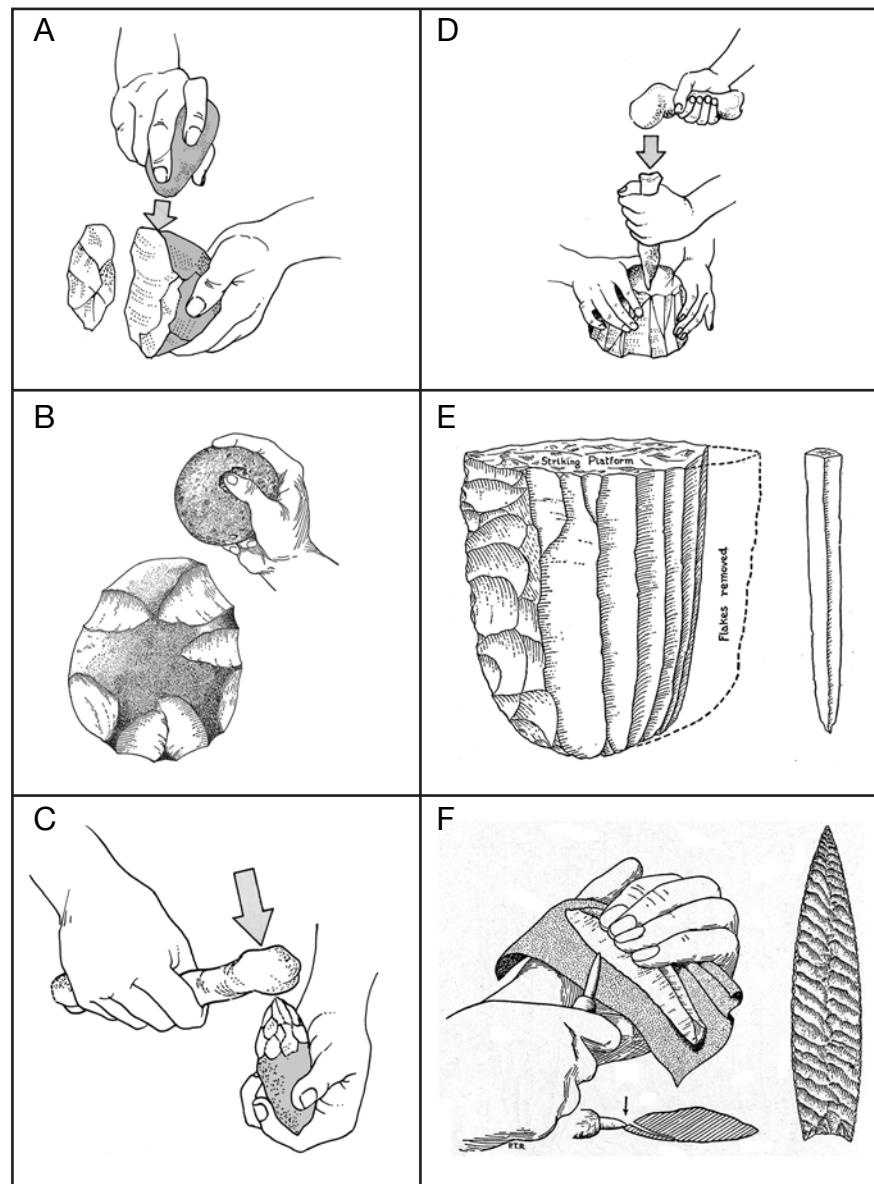


Fig. 9-20. Advances in Paleolithic technology: striking a pebble with a stone (A, B) or bone (C) as a hammer; the prepared core technique of producing uniform blanks with a chisel (D, E); and retouching the product with pressure flaking (F). (After, Boas, 1938; Oakley, 1961, and Ambrose, 2001)

unearthed (Karkanas et al., 2007). This suggests that fire was used not only to keep warm but for food preparation. The earliest hearths used in Europe is known from Terra Amata in France, dated to about 400 k.y.a. (de Lumley, 1969), and perhaps somewhat earlier at Torralba and Ambrona in Spain (Tattersall, 1995). However, the advance from producing multipurpose tools to crafting special purpose tools is attributed to *Homo neanderthalis*. The lithic industry associated with the Neanderthals is known as the Mousterian and it endured from about 250 k.y.a. to about 40 k.y.a.

MOUSTERIAN TOOLS. The Mousterian industry of *Homo neanderthalis* is characterized by the production not only of multipurpose hand axes but also special tools. Long blades were either laboriously turned into finely wrought bifaces by pressure flaking (Figs. 9-20F, 9-21D)

or given a special shape (Fig. 9-22) to be used as special purpose tools, such as knives with sharp edges for cutting skin and meat; scrapers for dressing animal hides to make clothing or to serve as tent covers; burins, denticulates, and notched or serrated blades for woodworking, and so forth (Bordes, 1961; Springer and Gamble, 1993; Wynn, 1999; Klein, 1999). Short blades were turned with a few strikes into sharp points (Figs. 9-21A, B, C), and were presumably hafted to spears to hunt animals, including large ones like horse, rhinoceros, bison, brown bear, and deer. The binding material of these compound artifacts was plant twine, with resin used as an adhesive (Lombard, 2005). These stone tools, whether simple or elaborate, must have been the products of well-trained specialists who followed standardized procedures. The diversity of stone artifacts also suggests increasing technical specialization, such as sawing, shaping, shaving and drilling wood, preparing fur and leather garments, and using long distance projectiles (Brooks et al., 2005). This advance, beginning in the Middle Paleolithic became a standard in the advanced cultures of the Late Paleolithic.

SIMPLE AND RETOUCHEED MOUSTERIAN STONE TOOLS

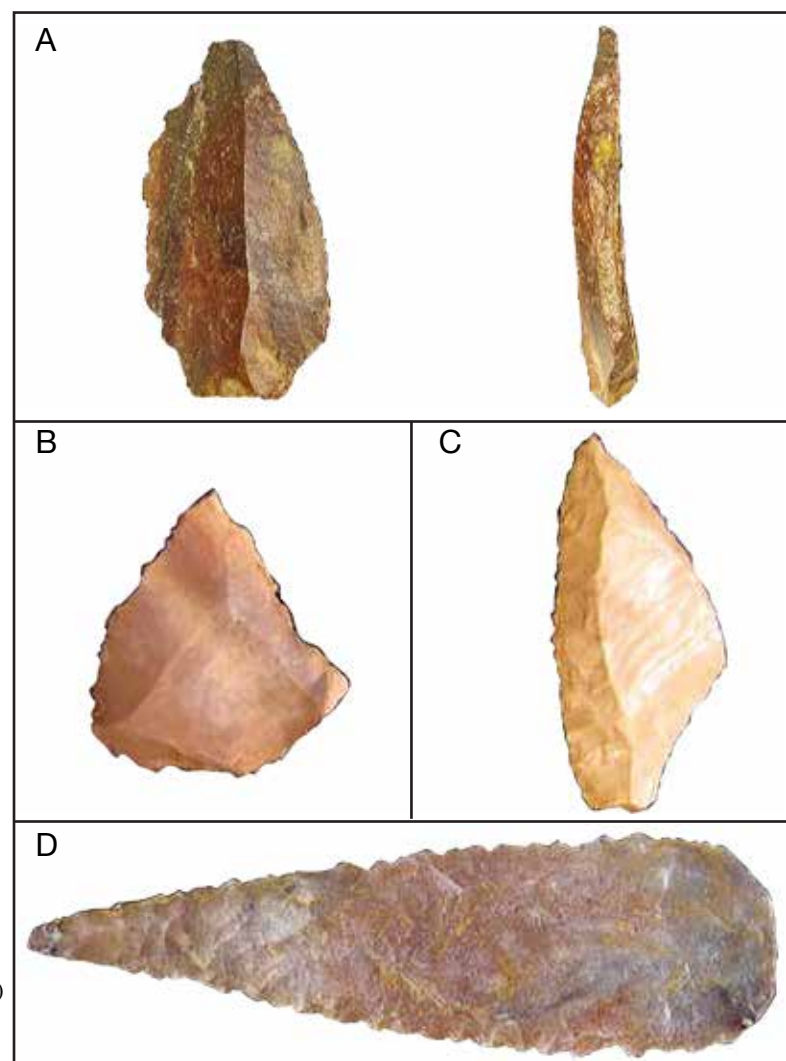


Fig. 9-21. Special purpose Mousterian tools that might have been used as a scraper (A), a knife blade (B), and a saw blade (C). (A, from Paleodirect.com; B, from Agsbach.de.jpg; C, from Naksimages.jpg)

PRODUCTION OF AURIGNACIAN
SPECIALIZED TOOLS

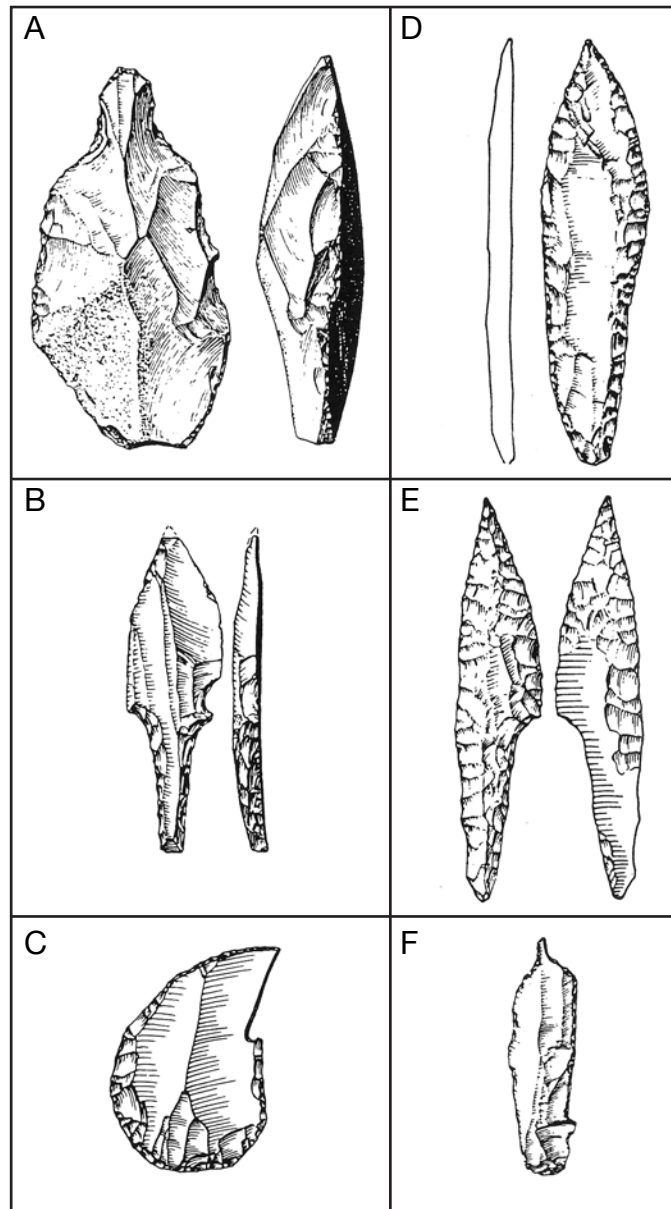


Fig. 9-22. Special purpose, retouched Aurignacian implements designed for hafting. (After Laville et al., 1980; from Wynn, 1999)

9.3.4. Late Paleolithic Cultures: The Production of Special Purpose Tools. The next stage in technological advance, the emergence of Late (or Upper) Paleolithic tool production began about 45-40 k.y.a. (Sheratt, 1980; Binford, 1983; Gamble, 1986; Ambrose, 1998; Bar-Yosef, 1995; 2002). This culture is associated with the worldwide dispersal of anatomically modern humans, who colonized the globe as far as Australia, and replaced the Neanderthals in Eurasia and advanced hominins in the Far East (Stringer, 1988, 2002; Mellars, 2004; Wild et al., 2005; Holt and Formicola, 2008). Among the technological advances of the Late Paleolithic were the invention of the bow and arrow for hunting and warfare; the use of hooks

and harpoons for fishing; and the use in daily life of small blades and sharp points—presumably hafted to wood, bone and antlers—and ivory needles with holes for sewing (Fig. 9-23). These new tools reflect a diversification in the exploitation of environmental resources, and it has been associated with the formation of permanent settlements, the accumulation of property, and the production luxury items, art works and ceremonial objects (discussed in Section 9.3.7). The Late Paleolithic has been most extensively studied and documented in Europe, where different cultures—the Aurignacian, Gravettian, Magdalenian, and others—followed one another, presumably as different human groups moved back and forth while the massive ice sheets expanded southward and then retreated during different phases of the Ice Age.

The Aurignacian culture appeared in Western Europe about 40 k.y.a. and disappeared about 28 k.y.a. At one site, evidence was gathered that the Aurignacians hunted migrating reindeer and horse and transported their entire kill to their cave for processing (Niven, 2007). There is some evidence that the Gravettians lived in larger semi-sedentary communities and developed improved subsistence techniques. The Gravettians used nets to capture smaller prey, such as hare, fox, red deer and reindeer, hunted large game, like mammoths and mastodons, and also engaged in an intensive exploitation of aquatic resources, such as fish, shellfish and seals (Haynes, 1991; Pringle, 1997; Svoboda et al., 2004). The subsequent Magdalenian culture became widespread in Europe during the Late Paleolithic, as climatic conditions improved greatly between 18-10 k.y. a. Population increased considerably during this period not only in southern but also northern Europe and larger settlements were beginning to form in areas near caves and seasonal hunting and fishing sites (Conkey, 1986; Charles, 1996; Housley, 1997). This was a prosperous period as attested to, for instance, by the cave paintings of Lascaux (Vouvé et al., 1982; Rousot, 1992). While the Magdalenians in Europe, and comparable

MAGDALENIAN PROJECTILES, HARPOONS AND NEEDLES

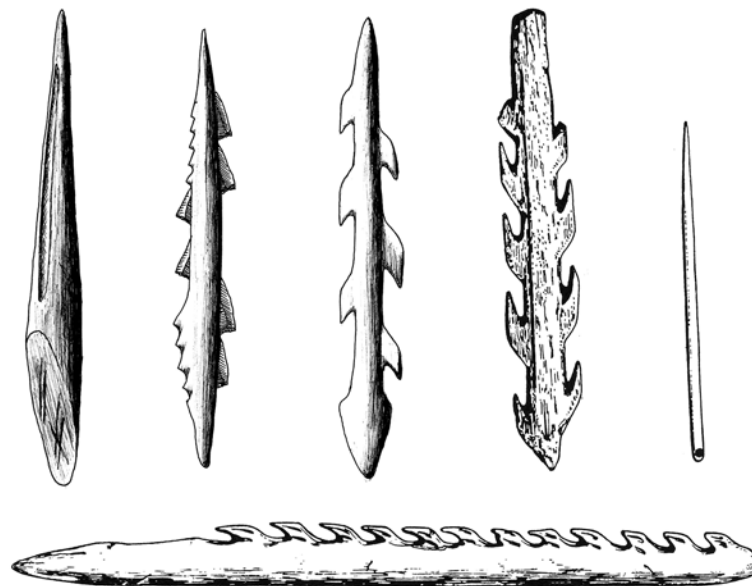


Fig. 9-23. Magdalenian artifacts made of ivory, bone and antlers. (From *Proyectiles oseos magdalenians.jpg*)

peoples elsewhere, represent the zenith of Late Paleolithic technical advancement, it also signaled the end of a period. By decimating the herds of large mammals, and causing the extinction of many of them, they were instrumental in bringing to an end a period in human evolution based on a predatory economic order.

9.3.5. *The Mesolithic Transition: Decimation of the Megafauna and Establishing Settlements.* The skilled but unrestrained predatory behavior of the Late Paleolithic hunters led to the decimation and extinction of most large mammalian species (megafauna) and the collapse of a bountiful ecosystem.

EXTINCTION OF THE MEGAFUNA. There is evidence for a relationship between hunting expedience and the extinction of the regional megafauna. Upon colonizing Australia as long as 40 k.y.a., the giant land animals disappeared (Roberts et al., 2001; Miller et al., 2005; Rule et al., 2012). These included a giant kangaroo, a wombat-like animal the size of a hippopotamus, a tortoise of similar size, and a giant flightless bird. Likewise, following the crossing of the Bering land bridge and penetration of the Americas by hunters about 1.3 k.y.a, a host of large mammals—giant sloths, saber-toothed tigers, native horses, mammoths, and mastodons—became extinct (Haynes, 2002; Martin, 2005; Lister and Bahn, 2007; Nogués-Bravo et al., 2008; Prescott et al., 2012). The mammoths and mastodons were the favorite prey of Siberian and North American hunters not only because they were a source of large quantity of meat and fat (which they could freeze to preserve) but because other parts of the carcasses could also be put to good use: the large and heavy bones as structural elements of tents; the hide as tent covers; the tusks as weapons, tools, and decorations. Although climatic changes may have played a role in the disappearance of mammoths, as their geographical range diminished considerably after 42 k.y.a, the species did endure through a series of interglacial epochs, and a small population of dwarf mammoths survived in the Wrangel Islands of Siberia until about 3.5 k.y.a. (Vartanyan et al., 1993). Likewise, gorilla-sized lemurs, elephant birds, giant tortoises and hippopotami became extinct following the arrival of humans about 2.3 k.y.a. in Madagascar (Burney et al., 2003), as did the giant, flightless moas of New Zealand after the arrival of Maoris about 1.0 k.y.a. (Holdaway and Jacomb, 2000). As a consequence of the decimation of an entire ecosystem, the big-game hunters had no choice but to seek new ways to satisfy their survival needs. They did that by occupying fertile grounds, domesticating plants and animals, and establishing enduring homesteads, hamlets and villages. However, as it has been recently established, this transition from hunting to farming was preceded by a semi-sedentary culture known as the Mesolithic.

ADOPTION OF A SEDENTARY LIFE STYLE IN THE LEVANT. It is now well established that the sedentary village life style was adopted in the Levant several millennia before the invention of domestication of plants and animals (Akkermans and Schwartz, 2003; Watkins, 2010). There is archeological evidence for a loss of large ungulates (deer, goats and boar) in this region during the Late Paleolithic and Mesolithic, and people turned to hunting locally available small mammals, such as gazelles and hares, birds, like partridges, and amphibians, in particular tortoises (Stiner et al., 2000; Munro, 2003; Davis, 2005). People settled in fertile regions where wild wheat and barley abounded, supplementing the meager meat supply. Granaries for cereal storage, dated to over 11 k.y.a., have been identified in the Jordan Valley (Kuijt

and Finlayson, 2009). These Mesolithic settlements were first recognized by Dorothy Garrod in Palestine and have more recently been excavated in Israel, Kurdish Iraq, Iran and Turkey (Henry 1989; Belfer-Cohen, 1991; Bar-Yosef, 1998). Dated to 12.5-9.5 m.y.a., the settlement consisted of subterranean round stone houses with a central fireplace (Fig. 9-24). The typical stone tools used by the occupants were small blades, arrowheads, and, as a novelty, flint-bladed sickles, grinding stones and mortars. Tools made of bone, included harpoons and fishhooks. At another site in the Jordan Valley, remnants of stored figs of the same antiquity have been uncovered (Kislev et al., 2006). It is controversial whether these early settlers have begun to domesticate plants; according to one report, the cultivation of rye was initiated along the Euphrates as long as 13 k.y.a. (Hillman et al., 2001).

A ROUND SUBTERRANEAN BUILDING IN THE PRECERAMIC PERIOD



Fig. 9-24. A Mesolithic subterranean circular building with a central fireplace from Jerf al-Ahmar, Syria. (From Akkermans et al., 2003)

9.3.6. The Neolithic Revolution: Building Permanent Villages and Domesticating Plants and Animals. The transitional, semi-sedentary life style of the Mesolithic was followed in the Levant by the formation of permanent village communities by farmers cultivating domesticated plants and breeding domesticated animals. Childe (1936) called the event the “Neolithic Revolution,” referring to the fact that the people of these communities produced polished stone tools (axes, adzes, chisels, mortar and pestle) in addition to the more ancient flaked tools. Although, as we now know, the transition from nomadic hunting and gathering to a sedentary life style in hamlets and villages was a gradual process, the term “Revolution” is appropriate in the sense that change from environmental exploitation by hunters to environmental enrichment by farmers was a momentous event in human evolution. The momentous innovation of Neolithic societies, in the Levant and elsewhere, was cultivating the land with domesticated plants and breeding domesticated livestock (Braidwood, 1967; Henry 1989; Smith, 1998, 2001; Zohary and Hopf, 2000; Diamond, 2002; Bellwood, 2004; Gupta, 2004; Barker, 2006). That was not only a novel way of assuring a food supply but a fundamental change in social organization and mental attitudes. It involved, first, the “domestication of people” (Wilson, 1988), who had to learn how to live and cooperate with others than kin in expanding communities (Kuijt, 2000; Kozłowski, 2002; Akkermans and Schwartz, 2003; Banning, 2003; Watkins, 2010). Second, it required a shift from the mindset of nomadic hunters with their frenzied daring, bravery and excesses, to the mindset of farmers, who had to behave calmly, prudently and frugally.

THE FORMATION OF PERMANENT VILLAGES. The earliest Neolithic villages in the Levant consisted of rectangular buildings erected on the ground (Fig. 9-25A). The buildings were made of brick or stone, with indoor hearths for cooking and keeping warm, and with silos for storing crops. Some of the villages were small, others quite large with tightly arranged units (Fig. 9-25B). Some of these villages endured for hundreds of years, being rebuilt on top of one another after the earlier buildings fell apart or were destroyed, forming mounds (Tells) on the plains and hills.

One of the earliest and long-enduring neolithic villages was Jericho in the Jordan Valley (Kenyon, 1957; Holland, 1997). Jericho consisted of stone dwellings and defense walls, and at times was big enough to accommodate as many as 2000 to 3000 people. Jericho has been

RECTANGULAR NEOLITHIC BUILDINGS

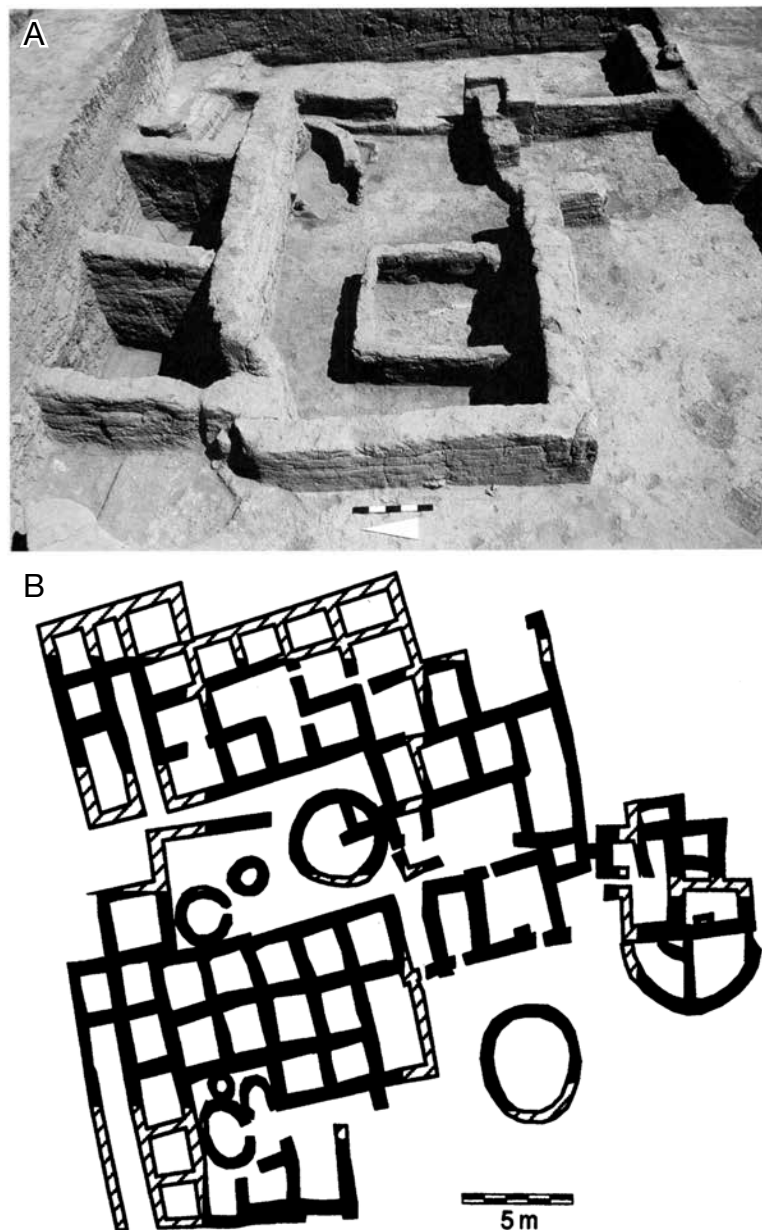


Fig. 9-25. Neolithic ground level rectangular building (A) and a village settlement (B) from Tell Sabi Ayad, Syria. (A, from Akkermans et al., 2006; B, from Banning, 2003)

repeatedly destroyed and rebuilt, and two periods have been distinguished in its prehistory: a prepottery period beginning about 11.5 m.y.a., and a pottery period beginning about 8.5 m.y.a. The prepottery period was concurrent with the Mesolithic Natufian culture; the pottery period was Neolithic. Another site, Jarmo in Kurdish Iraq, dated to about 9.0-5.8 m.y.a., was a small village of about 20-25 mud-brick houses, each with several rooms (Braidwood, 1950). Its inhabitants grew domesticated wheat, barley, and lentils, which they ground on querns or mortars. They also had domesticated goats, sheep and pigs, and possibly cattle and horses. The sickles used by the villagers were studded with obsidian mined over 300 miles to the north, suggesting that they engaged in bartering. Recently, a prepottery settlement with stone buildings has been excavated at Tel Qaramel in Syria, dated to 10.7 and 9.5 k.y.a. (Mazurowski, 2006); and a larger village at Tell Sabi Abyad with early pottery (Akkermans and Schwartz, 2003; Fig. 9-27A).

Another partially excavated settlement, consisting of two mounds built along an ancient riverbed, is in Çatalhöyük in Turkey (Mellaart, 1960, 1975; Hodder, 2006). The larger village was inhabited from 9.4 to 8.0 m.y.a.; the smaller one from 8.0 to 7.7 m.y.a. The houses in the larger village were built of mud brick, with the walls plastered and decorated with paintings. The houses had clay ovens for heating and cooking, and many of them also contained various art objects. These rectangular houses were packed tightly together, without footpaths or streets between them. Presumably as a defense measure, they had to be entered from above through a hole in the ceiling by a ladder. 5,000 to 8,000 people might have occupied the village. The farmers of this community grew wheat, barley and peas, had domesticated sheep and goats, and experimented with the domestication of pigs and cattle. A later established village, which flourished about 6.0 to 5.3 m.y.a., is Tell Halaf in northern Syria (Hijara, 1997; Munchaev, 1997). Other neolithic villages have been excavated in Israel (Stekelis, 1972; Garfinkel, 1993) and Jordan (Kuijt and Finlayson, 2009). Gradually, Neolithic culture spread from the Levant to Europe (Champion et al., 1984; Hodder, 1990; Whittle, 1996; Perlés, 2001; Budja, 2009). Greece was settled by Neolithic farmers along the floodplains of Thessaly about 8.5 k.y.a., and agricultural settlements formed along the river valleys of the Balkans, Russia and Hungary, and along the Mediterranean by about 7.0 k.y.a. Neolithic settlements developed in Central Europe by about 6.5 k.y.a. and in Northern Europe by about 6.0 m.y.a. The building of solid houses, and in many cases plastering and decorating the walls, and keeping them in good repair reflects a change in the mental attitude of farmers relative to nomads, i.e., an attachment to home and property and the appreciation of the comforts they provide.

THE DOMESTICATION OF PLANTS. The domestication of wheat (einkorn, emmer), rye, barley and lentil began in the Levant about 9.0 k.y.a. (Zohary and Hopf, 2000). But there is emerging evidence that plant and animal domestication—an early form of genetic engineering—took place in several areas outside this “core area,” involving different wild stocks and following a different time course (Fuller et al., 2012). Rice may have been initially domesticated in China as early as 15 k.y.a., but due unfavorable climatic changes there was a hiatus in its cultivation and was started again about 12 k.y.a. (Lu et al., 2002; Sang and Ge, 2007). More recent studies suggest that the domestication of rice took place along the Yangtze Valley somewhere between 13.5 and 8.0 k.y.a. (Zhang and Hung, 2010; Molina et al., 2011). In the Americas, plant domestication was clearly an indigenous development (Pickersgill, 2007). Several thousand

years after the colonization of the Americas by Late Paleolithic hunters, squash began to be cultivated in Mesoamerica about 10 k.y.a, and maize about 9.0 m.y.a. The domestication of manioc began in South America about 8.0 k.y.a., that of potato 7.0 k.y.a., and of yam and chili pepper about 6.0 k.y.a. The cultivation of squash and sunflower may have begun independently in North America about 5 k.y.a. (Smith, 2006).

THE DOMESTICATION OF ANIMALS. The earliest domestic animal was the dog, dated to as long as 33 k.y.a. at a Siberian site (Ovodov et al., 2011). Domestic dogs were unearthed at Paleolithic sites in Belgium, the Ukraine and Russia (Germonpré et al., 2009, 2011), with some of them intentionally buried (Losey et al., 2011). It is likely that wolves became camp followers of ancient hunters and orphaned wolves become attached to people who raise them. Farmers and pastoralists domesticated ungulates during the late Neolithic. Sheep were domesticated in the Mideast about 10.5 k.y.a., pigs about 9.0 k.y.a., and goats about 8.0 k.y.a. Domestic animals (sheep, goat) and plants (wheat, barley) were present in the Indian subcontinent as early as 11 k.y.a. (Allchin and Allchin, 1997; Gupta, 2004). That early date suggests that their domestication in India was an indigenous development. Humpless cows (*Bos taurus*) were domesticated in the Levant about the same time, but the cows domesticated in India about 7.5 k.y.a. are humped (*Bos indicus*).

THE ADVANTAGES OF LAND CULTIVATION AND LIVESTOCK BREEDING. Land cultivation is a strenuous and tedious task but it has its benefits. Hard labor is necessary to clear the land and plow the soil. Sowing seeds and nurturing the young plants to harvest requires sustained effort. But after all that trouble, the farmer is assured an ample annual supply of cereals, legumes, beets, and fruits. There are also advantages to feeding, corralling and protecting goats, sheep and cattle, because they can be slaughtered and butchered when needed to get their meat, fat, and hide. While in earlier times, when large herds roamed the lands, hunting offered greater returns with less effort, people were forced to devise new ways to survive and prosper once the local megafauna was decimated. And while not without its uncertainties, such as droughts, floods and pestilence, land cultivation and livestock breeding can ensure the subsistence needs not only of a family or a small group but also a large community. That, in turn, allows some division of labor, and the support of artisans who can produce goods to be bartered for desirable things that are not locally available. Instead of living from hand-to-mouth, as mobile nomads do, farmers became property owners who could pass on their valuables to the next generation.

POLISHED STONE TOOL AND POTTERY PRODUCTION. Two novel artifacts are associated with the Neolithic, the production of polished tools and pottery. The polished axes, adzes, hammers and hoes with drilled holes into which wooden handles could be inserted (Fig. 9-26A), were used for clearing forests, cutting timber, tilling the land, digging postholes and trenches, and building houses and protective walls. In addition, farmers produced another set of artifacts to process, store, and transport what they harvested (Fig. 9-26B). The cereals had to be ground into flour, protected from vermin, mice and rats, and prevented from becoming spoiled. These utensils were made of stone, wood and pottery. Much like the domestication of plants and animals was an early feat of tacit genetic engineering, the turning of mud and clay into hard and enduring pottery by using fire was the earliest feat of chemical engineering. Interestingly, however, the beginnings of pottery making did not directly coincide with the onset of the

NEOLITHIC TOOLS AND DOMESTIC GOODS

A



B



Fig. 9-26. A. Neolithic polished stone tools in various phases of production. B. Stone, wood and ceramic domestic implements. (From Jungsteinzeit 2700 BC.jpg)

Neolithic. As we noted earlier, there was a prepottery period in the Mideast. Conversely, pottery was found in cave dwellings in China as long as 16 k.y.a., much before the Neolithic (Zhang, 2002; Zhang and Hung, 2010). Similarly, pottery has been produced, before the Neolithic, in the Russian Far East about 11 k.y.a. and in Japan 10 k.y.a. (Kuzmin, 2006, 2010).

PRIMITIVE AND ADVANCED POTTERY

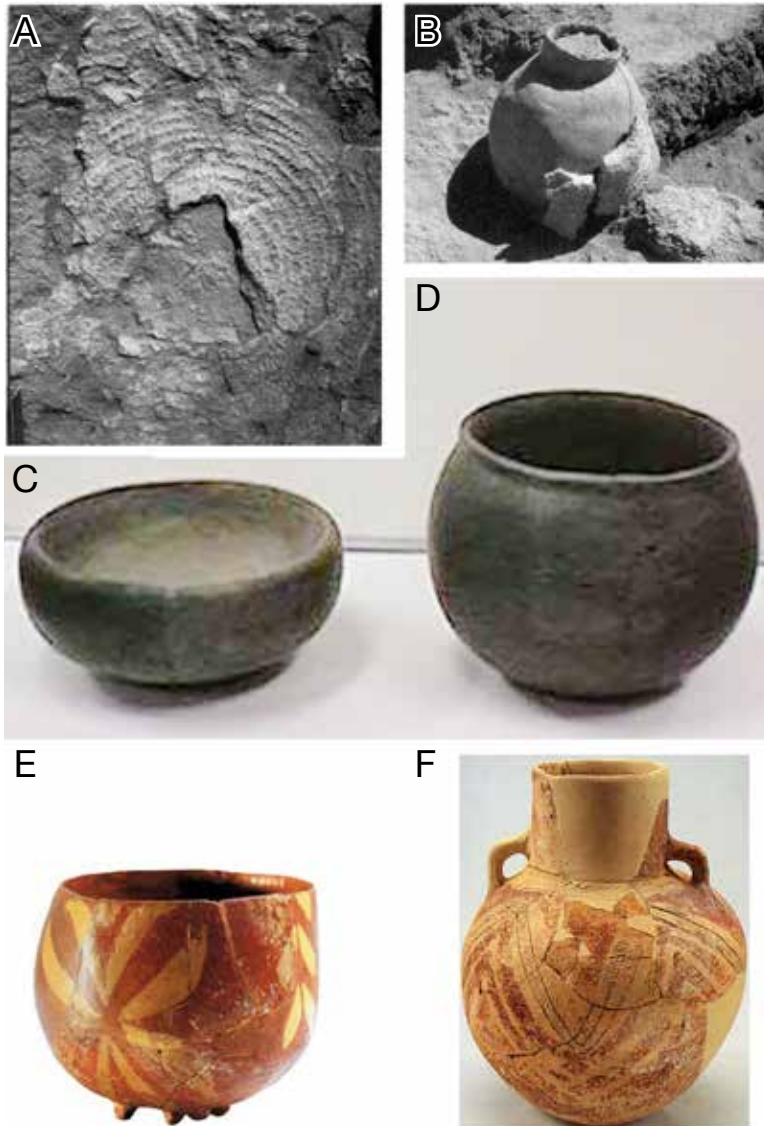


Fig. 9-27. Examples of Neolithic pottery from primitive “white ware” storage vessels (A), to pots designed for different uses (B, C, D), and as decorated luxury goods (E, F). (A, from Akkermans et al., 2006; B-D, from PotteryNeolithic.pdf; E-F, from Budja, 2009)

During the prepottery period in the Levant, vessels with lime plaster, called “white ware,” were produced to store grain and other products (Fig. 9-27A). (These may have been the linings of gourds or baskets.) During the early pottery period, suitable clay was procured, the vessel was molded by hand to assume a particular shape, and dried in the sun. Later, the soft product was fired in an open pit to turn the clay into a hard ceramic substance. Still later, firing at higher temperatures in kilns produced ceramic vessels of much higher quality. The earliest ceramic wares had a simple shape and finish, designed to serve as utilitarian cups and bowls and storage vessels (Fig. 9-27B, C, D). In time, artisans began to produce engraved or painted ceramic wares of fancy shapes as luxury goods for local use and trading (Fig. 9-27E, F).

9.3.7. Archeological Evidence for the Evolution of Art. There is currently no evidence that the hominids that made Oldowan tools produced enduring works of art. The first hint of the dawn of an artistic endeavor comes from the shaping of finely wrought symmetrical Acheulean hand axes. Many of these were apparently not designed to be working tools. Some were too big to be handheld; some had sharp edges all around, making them difficult to hold tight in one's hand without injuring oneself; some were too fragile to be used as practical instruments. The fine workmanship of some bifaces suggests that they were luxury products. Another manifestation of the emergence of an aesthetic sense is the use of red ochre, presumably as ornamental body paint. There is some evidence for ochre use as early as 500 k.y.a., and more regularly by 300 k.y.a. (Barham et al., 2002). That practice may have been initiated by *Homo heidelbergensis*. Figurine carving developed later. A small pebble found at Berekhat Ram in the Golan Heights, and dated to about 230 k.y.a. (Goren-Inbar, 1985; d'Errico and Nowell, 2000) may be a man-made female figurine (Fig. 9-28A). The "Venus of Tan-Tan" (Fig. 9-28B), discovered in Morocco and dated to between 500-200 k.y.a. (Bednarik, 2003), is undoubtedly a carved figurine. But apart from these rare products, there is little evidence that the hominins of the Middle Paleolithic routinely produced enduring art works.

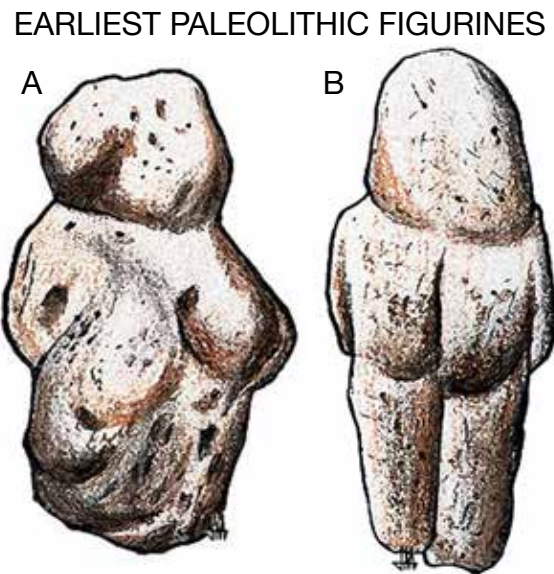


Fig. 9-28. A. Early Paleolithic pebble that may have been a carved figurine from the Golan Heights, known as the Venus of Berekhat Ram. B. Middle Paleolithic carved stone figurine from Morocco, known as the Venus of Tan-Tan. (From Marc I. Vermeersch's blog)

ART WORKS PRODUCED BY HOMO SAPIENS. Coincidentally with the emergence of archaic *Homo sapiens*, pigment use was identified at African sites dated to about 160 k.y.a. (Marean et al., 2007). Shells with ochre paint, and ochre on the body of buried children and adults were discovered in Israel and dated to about 92 k.y.a. (Vandermeersch, 1969; Valladas et al., 1988; Hovers et al., 2003; Bar-Yosef Mayer, 2009). Perforated shell beads together with ochre engraved with geometric patterns were unearthed at the Grotte des Pigeons in North Africa, dated to about 82 k.y.a., and at Blombos Cave in South Africa, dated to about 75 k.y.a. (d’Errico et al., 2005, 2009; Bouzouggar et al., 2007; Henshilwood et al., 2009; Fig. 9-29)). There is no clear evidence that the Neanderthals routinely produced art works. The recently discovered simple drawings in the Nerja Cave of Andalusia, tentatively dated to be about 43 k.y.a., is attributed to Neanderthals (Sanchidrián, 2012) and may be an exception.

Beginning about 35 k.y.a., modern *Homo sapiens* began to produce high quality representational art works. These included small female figurines carved of stone, bone and ivory, and larger rock engravings and paintings produced in caves. A recently discovered figurine in Germany, carved from a piece of mammoth ivory, known as the Venus of Hohle Fels (Fig. 9-30A), has been dated to about 35 k.y.a. (Conard, 2003). The figurine was carved with exaggerated feminine features and may be an amulet symbolizing fertility. Two other well-known figurines produced in the same cultic style, but with greatly improved workmanship, are the Venus of Willendorf from Austria (Fig. 9-30B) and the Venus de Lespugue from the foothills of the Pyrenees (Fig. 9-30C). Both of them have recently been dated to about 24 k.y.a. Examples of figurines produced at a later date (about 17 k.y.a.) in a naturalistic style, are the elegant Venus de Brassempouy ivory figurine (White, 2006; Fig. 9-31A) and the Magdalenian stone carving of a horse head (Fig. 9-31B).

MIDDLE PALEOLITHIC DECORATIVE ART



Fig. 9-29. Middle Paleolithic pierced shells (top) and ochre with carved geometric patterns (bottom) from South Africa. (From BBC-shell-beads.jpg)

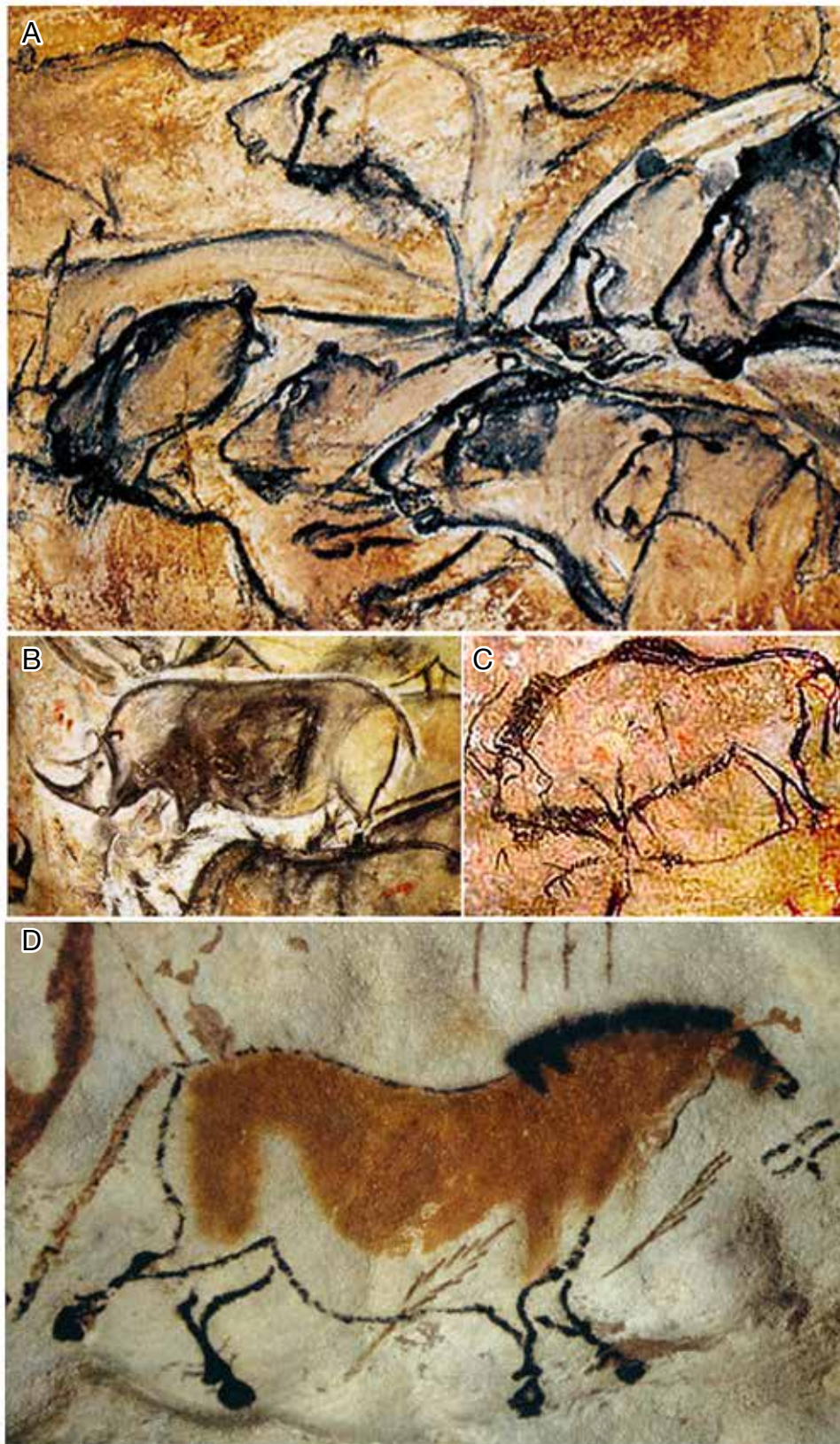


Fig. 9-30. Late Paleolithic cultic figurines, with exaggerated feminine characteristics but without facial features. **A.** The Venus of Hohle Fels, from Germany. **B.** The Venus of Willendorf, from Austria. **C.** The Venus de Lespugue, from France. (A, from Conard, 2009; B, from Haywood, 2000; C, from Musée d l'Homme, Paris)

Fig. 9-31. Late Paleolithic naturalistic representations of a lady's (**A**) and a horse's (**B**) head. (A, from Venus-de-Brassempouy.jpg; B, from Magdalenian-horse.jpg)

About 350 caves containing ancient art works are known in Europe, extending from southern Spain to Siberia (Chauvet et al., 1996; Clottes, 2003). Some of the art is in shallow caves where people lived, others in the depth of caves that were not inhabited. The artworks included engravings in rock, sculptures made of clay, outline drawings in charcoal, and homochromatic and heterochromatic paintings. Cave paintings were widespread in France, in particular the Perigord region, where the most common subjects were animals such as horses, aurochs, bisons, mammoths, rhinoceroses, lions, stags and bears. The portraits of lionesses in motion (Fig. 9-32A) and of a rhinoceros (Fig. 9-32C) at Chauvet Cave are dated to about 33 k.y.a; the bison at Niaux Cave (Fig. 9-32B) is more recent, and the horse at Lascaux (Fig. 9-32D) less than 15 k.y. old.

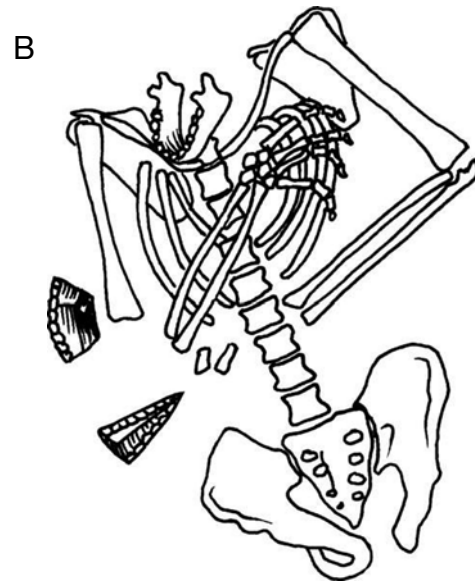
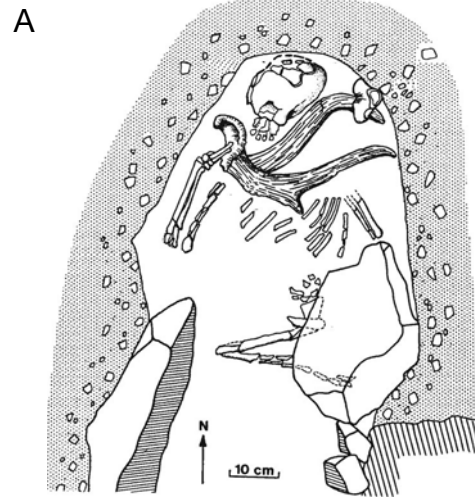
LATE PALEOLITHIC CAVE DRAWINGS AND PAINTINGS



MIDDLE PALEOLITHIC BURIAL SITES

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Fig. 9-32. Late Paleolithic paintings of lions (A) and a rhinoceros in Chauvet Cave (B), of a bison in Niaux Cave (C), and of a horse in Lascaux Cave (D) in France. (From Bradshawfoundation.com)



→

Fig. 9-33. Middle Paleolithic burial sites in Israel with grave offerings. A skeleton accompanied by an offering of a deer antler in Qafzeh Cave (A) and stone tools in Kebara Cave (B). (A, from Vandermeersch et al., 1970; B, from Bar Yosef et al., 1992)

9.3.8. Archeological Evidence for the Evolution of Religion and Morality. The first archeological indication for moral behavior and religious belief comes from the ritual burial of the dead. There is currently no evidence that the hominins of the Early Paleolithic engaged in that practice. Burial practices may have begun late in the Middle Paleolithic. In the caves of Skhul and Qafzeh at Mount Carmel in Israel, skeletal remains with Neanderthal features, dated to about 100 k.y.a., were found with red ochre, sea shells and deer antler as possible grave goods (Belfer-Cohen and Hovers, 1992; Hovers et al., 2003; Fig. 9-33A). In the nearby Kebara Cave, a buried partial skeleton of a Neanderthal man, dated to about 60 k.y.a., was accompanied by stone tools (Bar-Yosef et al., 1992; Fig. 9-33B). Pollens found with the skeleton of a Neanderthal at Shanidar Cave in Iraq were hypothesized to be ornamental flowers buried with the dead (Solecki, 1971).

LATE PALEOLITHIC BURIAL
WITH SIMPLE GRAVE GOODS



Fig. 9-34. Late Paleolithic grave, with modest offerings of seashells, stone bracelets and dishes at Cys-la-Commune, France. (From Musée des Antiquités Nationales)

LATE PALEOLITHIC BURIALS AND GRAVEYARDS. But it was not until the Late Paleolithic that the dead were unmistakably buried in dug graves together with goods, such as tools and utensils, shells or beads in the form of headdresses and necklaces, bracelets carved of ivory or stone, and other offerings (RielSalvatore and Clark, 2001). As illustrated in Fig. 9-34, an individual was laid to rest at Cys-la-Commune in northern France, on its side with flexed posture and accompanied by several grave offerings. Most notable of the latter were the *Spondylus* shells which, coming from Mediterranean waters, must have been precious items obtained by trading. Accompanied by even greater riches was the individual buried at Sunghir near Moscow about 28 k.y.a., with ivory beads covering his body and several bracelets on his arms (Fig. 9-35). Burial of the dead was widespread throughout Europe, such as Moravia (Svoboda, 2008) and the Italian Peninsula (Giacobini, 2007). In the latter region, over 50 Upper Paleolithic graves were discovered in caves or rock shelters and dated to the time span between 25 and 10 k.y.a. The buried included children, adolescents and adults, females and males, some with few goods,

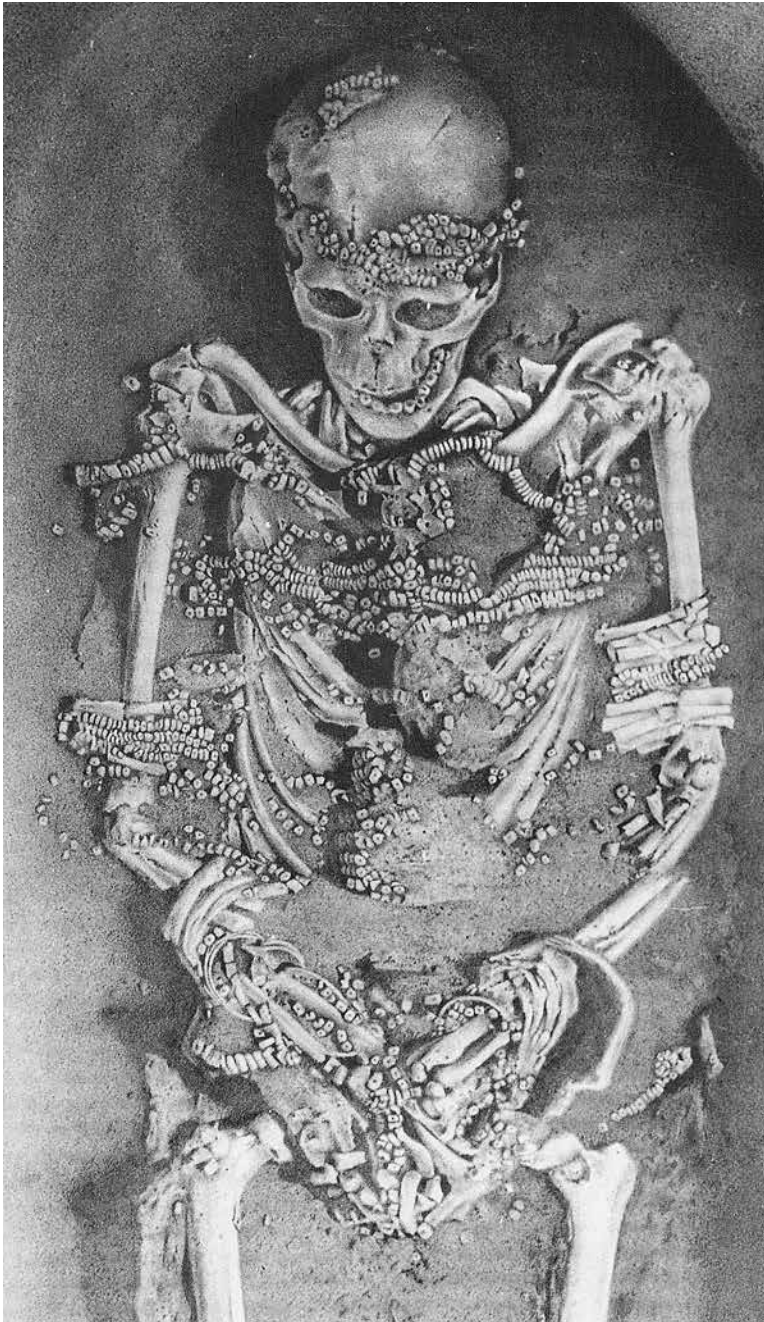
LATE PALEOLITHIC BURIAL
WITH LAVISH GRAVE GOODS

Fig. 9-35. Late Paleolithic grave from Sungir, near the city of Vladimir, Russia, with a man buried in a garment and a cap richly decorated with mammoth ivory beads and other jewelry. (From Bader et al., 1998)

others with many. Evidently, the living felt a moral obligation to bury their dead and the rituals suggest that they entertained ideas about life after death.

A MESOLITHIC SANCTUARY. At Göbekli Tepe in Turkey, Schmidt (2010) and his associates have been excavating a hilltop that is the site of the earliest known megalithic religious center. The site contains over half a dozen circular structures, each consisting of eight T-shaped circumferentially arranged limestone pillars, with two pillars at the center (Fig. 9-36A). The

MESOLITHIC CULTIC SITE OF GÖBEKLI TEPE



Fig. 9-36. A. Mesolithic sanctuary at Göbekli Tepe in Turkey. B and C, examples of the large hewn pillars with carved animals and symbolic representations. (From Göbekli Tepe, Urfa.jpg)

pillars, which are suggestive of a stylized upright human body, have carvings in relief, such as a single animal (Fig. 9-36B) or a menagerie of animals (Fig. 9-36C). The preponderance of animal carvings indicates that the sanctuary was dedicated to the worship of symbolic animals, perhaps the totems of the different clans. There were two stages in the building of the Göbekli Tepe. The first, with more elaborate edifices, has been dated to about 11.0 k.y.a.; the second to about 10 k.y.a. Since there are no indications that people lived there, the site must have been a temple ground or sanctuary. And since the heavy stones were quarried as far as 100-150 meters from the site and carted uphill, the construction of the sanctuary required a large workforce, presumably organized by a managerial elite, or a priestly class. Evidently, antedating the Neolithic Revolution, hunter-gatherer clans were sufficiently advanced socially to cooperate in building a shared sanctuary.

NEOLITHIC BURIAL AND WORSHIP PRACTICES. A new development during the Neolithic was the burial of the dead close to where people lived, either under the house floor or close to the house. Often the headless skeleton (Fig. 9-37A) and the head were buried separately, the latter often covered with plaster to better preserve its facial features (Fig. 9-37B). This ritual practice was documented at Tell Aswad in Iraq (Akkermans and Schwartz, 2003) and

at Köşk Höyük in Turkey (Özbek, 2009). Another development was the apparent worship of divinities, principally in the form of a fertility goddess (Fig. 9-38). Statues or figurines of these goddesses were unearthed at Çatal Höyük in Turkey (Mellart, 1967; Hodder, 2006), several villages in Syria (Akkermans et al., 2003; Kanjou, 2009), and at other sites (Kuijt, 2008, 2008; Watkins, 2010). Another Neolithic development was the communal feast that accompanied funerals. This was documented at a Prepottery site at Kfar HaHoresh in Israel where eight wild aurochs were slaughtered and their bones buried with the deceased (Goring-Morris and Horwitz, 2007). It was calculated that the flesh of the animals might have fed as many as 2500 people. What could have motivated people to engage in the gruesome practice of dismembering their dead, living closely with their skeletal remains, filling their house with figurines symbolizing the dead, and feasting while laying them to rest? A likely explanation is that these rituals maintained spiritual continuity with the dead and kept them in memory. This brings us to a consideration of the mental underpinnings of cultural evolution. Accordingly we now turn to ethnological descriptions and anthropological interpretations of the daily life, social organization, and beliefs of nomadic hunters, and settled pastoralists, fishermen and farmers who survived until recently with minimal influences by modern civilization.

EARLY NEOLITHIC BURIAL PRACTICES

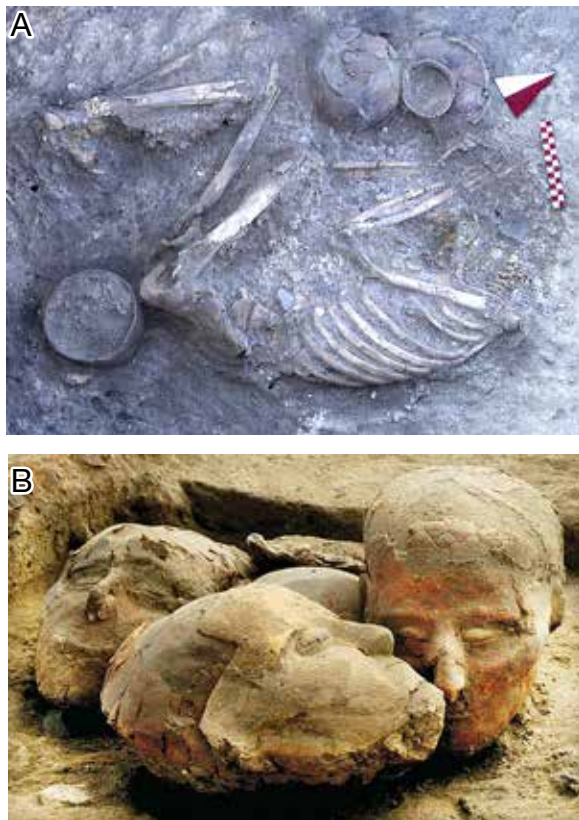


Fig. 9-37. Neolithic grave of a skeleton buried without a head (A) and of separately buried plastered heads under a house floor (B). (A, from Özbek, 2009; B, from Watkins, 2010)

NEOLITHIC FERTILITY GODDESS



Fig. 9-38. Neolithic sculpture of a seated woman, presumed fertility goddess, flanked by two leopards, at Çatal Höyük (From Ankara Museum B19-36.jpg)

9.4. The Cultural and Mental Evolution of Hominids and Hominins: An Interpretation Based on the Material Evidence

9.4.1. Stages in the Mental Evolution of Animals Relevant to Man's Ancestry. To put into perspective man's mental evolution, we begin by recapitulating the theory that we have developed in the preceding chapters regarding the stages of mental evolution in the line of animals that led to the emergence of the human species.

(1) *Protopathic sentience* emerged in protozoans that display goal-directed behavior. For instance, when a food-deprived amoeba begins to move about in search for food and upon detecting a bacterium follows and engulfs it, we may assume that it is driven and guided by an inchoate feeling (sentience) that has some properties of what we experience as hunger (Section 2.2.5, Fig. 2-7). However, the amoeba cannot possibly sense or be aware of what is out there because it lacks differentiated sense organs and a nervous system.

(2) *Qualeous sensation* emerged as a higher form of sentience in metazoans furnished with simple sense organs and a nervous system. For instance, a radial jellyfish that has several eyes and a peripheral nervous system (Section 2.3.6, Fig. 2-14), and displays visually guided obstacle avoidance (Fig. 2-17), may be granted the subjective experience (qualia) of vision, such as distinguishing light and darkness. However, since the eyes of jellyfish lack a large image-producing retinal surface, they cannot form a pictorial representation (percept) of what they encounter in their environment.

(3) *Configural perception* emerged in bilateral vertebrates with pairs of cranial eyes and a central nervous visual system. The large eyes of many fish have a fine-grained retinal surface, a complex oculomotor mechanism, and a topographically organized (retinotopic) optic lobe of the paleocephalon. These topographically organized sensory and neural mechanisms enable fish to form a patterned representation—model or image—of the shape, texture, size, and location of discrete objects in the external world (Section 3.3.1). Configural perception allows fish to recognize their own kind by their distinctive body markings and movements; distinguish different external objects by their shape; and construct topographic maps of their environment in which they can locate feeding sites, shelters, resting areas, and their home base. However, because fish lack mobile limbs with flexible digits to palpate, grasp and manipulate objects, their visual perception provides them with information only about the surface features of objects—their appearance—not their material composition and structural properties. Accordingly, we call this configural perception. Fish also display affective and mnemonic advances: emotional expressions of pain, hunger, fear, anger, lust and amicability (Section 3.2.5); and evidence for short-term and long-term recognition memory and, in some fishes, for recollection memory (Section 3.3.6).

(4) *Substantive perception*, the next stage in the evolution of awareness, refers to the recognition that objects are solid things with multifarious structural properties. This mental advance, we suggested, characterizes vertebrates that have (a) prehensile limbs with digits to grasp, pull, lift, squeeze and tear apart the objects they encounter, and (b) possess the neural ability to amalgamate the multisensory information obtained to construct a comprehensive

representation of the properties of those objects. This ability evolved in several lines of mammals but is particularly well developed in primates that have long and dexterous fingers and medially placed eyes and can palpate and manipulate objects under visual guidance (Section 6.5).

(5) *Concept formation* of an elementary kind, the construction of “sketchy concepts,” is the highest stage in the mental evolution of man’s closest relatives, such as chimpanzees. Chimpanzees can engage in hands-on (“on line”) reasoning and form categories of things and their relationships that can be visually portrayed or represented (Sections 7.4, 8.3.3). Subhuman higher primates also display affective and mnemonic advances. Their affective advance includes intense maternal affection, curiosity and playfulness, and gregariousness (Sections 7.1, 8.3.1); mnemonic advance, learning by imitation and a well-developed recognition memory and of recollection imagery (Sections 7.3; 8.3.2).

9.4.2. Hominid and Hominin Evolution: A Recapitulation of the Paleontological and Archeological Evidence. We have argued in the preceding chapter that we differ mentally from our closest animal relations, the chimpanzees, by our ability to form abstract ideas, anchor those ideas to verbal symbols, and thus engage in ideational (vicarious, “off-line”) thinking, reasoning and reflection. As a consequence, we have passed beyond *perceiving* what goes on in our environment to trying to *interpret* and *comprehend* why things are the way they are by asking such questions as “why,” “why not,” “who,” “where,” and “how,” and seeking answers to them. How did this new mental faculty evolve and how is it combined with our other mental faculties that are our animal heritage? The thesis that we develop below is that our need and ability to interpret what goes on in the external world is the product of two interrelated evolutionary advances, that of being able to think and reflect combined with the education we receive from our cultural institutions, which serve as repositories of all the knowledge accumulated by our ancestors and of the norms and values that guide our daily life. We discuss these evolutionary process by first considering here the advances made by the smaller-brained hominids and hominins, and follow that in the next Section by dealing with the cultural and mental evolution of modern humans.

There is some paleontological evidence that about 7-5 m.y.a., a line of apes evolved in Africa with skulls (and presumably brains) similar to chimpanzees (Figs. 9-1 to 9-3) but skeletal features suggestive of bipedality. Then several lines of hominids evolved about 4-3 m.y.a., with somewhat larger skulls (Fig. 9-4), a reduced muzzle, fully biped posture, and liberated hands. These, known as the early australopithecines, left no archeological evidence that they had a lithic culture. About 2.7 m.y.a., either some late australopithecines with larger brains (Fig. 9-6A) or *Homo habilis* began to manufacture simple unifacial stone tools, known as Oldowan choppers (Fig. 9-17). *Homo erectus* emerged about 1.8 m.y.a. with still larger brains (Fig. 9-6B), and concurrently finely wrought bifacial flaked tools appeared in Africa, known as Acheulean handaxes (Fig. 9-18). *Homo erectus* and bifacial tools appeared thereafter in Asia, first in the Levant and Georgia, and later in the Far East. This migration is known as “Out of Africa I” (Fig. 9-13A). A new human species, the robust *Homo heidelbergensis*, evolved in Africa about 800 k.y.a. with a much larger brain (Fig. 9-11A), and gradually replaced *Homo erectus* in Africa and Asia, and began to colonize Europe; this is known as “Out of Africa II” (Fig. 9-13B). The

traditional Acheulean tools were supplemented by improved implements produced with the Levallois technique (Fig. 9-20), beginning about 300 k.y.a., with the Mousterian technology (Fig. 9-21) emerging about 250 k.y.a. A new line of humans, the gracile *Homo sapiens*, with still larger brains (Fig. 9-11C) emerged in Africa about 200 k.y.a., and spread from there to the rest of the globe; this is known as “Out of Africa III” (Fig. 9-14). *Homo sapiens* reached the Levant about 100 k.y.a., China about 70 k.y.a., Australia about 50 k.y.a., Europe about 40 k.y.a., Siberia about 28 k.y.a., and North America about 18 k.y.a. The production of very high quality tools and weapons, as well as high quality works of art, began about 35 k.y.a., with the culture known as the Aurignacian (Fig. 9-22) and Magdalenian (Fig. 9-23). These cultures have been associated with nomadic hunters and gatherers of the Early-, Middle- and Late-Paleolithic periods. A transitional era began about 13 k.y.a., the Mesolithic, with people beginning to settle in villages with solid buildings (Fig. 9-24) along the rivers of the Mideast and some other sites. This was followed by a new era about 10 k.y.a, the Neolithic. *Homo sapiens* started a new career by becoming farmers and domesticating plants and animals.

With these considerations as a background, we now turn to the difficult task of trying to reconstruct the mental and cultural evolution of hominids and hominins using a closer examination of the available paleontological and archeological data.

9.4.3. Hominid Cultural and Mental Evolution: The Early and the Late Australopithecines. Chimpanzees in the wild “fish” for termites by taking a twig, removing its leaves, and inserting the denuded “tool” into the mound where the termites attach themselves to the twig, and then they are eaten. Chimpanzees may also fray the end of a twig with their teeth to increase the termite yield (Fig. 8-5). Chimpanzees have also been observed in a semi-wild setting to use stones as an anvil and a hammer to crack nuts (Fig. 8-7). Chimpanzees also engage in periodic hunts and kill smaller game, such as gazelles. They rarely use tools in these forays, and wild chimpanzees have never been observed to splinter cobbles or rocks to improve them as weapons or tools. A bonobo has been trained to fabricate stone tools with sharp edges to open a box containing a reward (Toth et al., 1993) but it never became proficient at the task, even after years of practice. The animal tended to select large cobbles, produced few cutting edges, and battered the stone with unsuccessful blows (Toth and Schick, 2009; Whiten et al., 2009).

Culture of the Early Australopithecines: The Eolithics. It is likely that the early hominids, who left behind no evidence that they produced modified stone tools, were mainly gatherers of plant food, like most apes, supplementing that diet by catching small animals, killing disabled larger animals, and scavenging on what was left behind by carnivores. Undoubtedly these hominids were aware of the herds of large browsers and grazers as potential prey but were handicapped in competing with the powerful carnivores with canines and claws and greater physical strength. However, the australopithecines had two advantages: freed hands to wield weapons and a superior intelligence that enabled them to using cunning.

STEALTHY SCAVENGING. We have no direct information about the scavenging and hunting techniques of the early australopithecines. Without the knowledge how to produce stone tools they probably relied on wooden weapons, such as sticks and clubs (which are perishable) to hunt

small game and to defend themselves from assaults by the large carnivores as they scavenged. They may have fractured pebbles or cobbles by random percussive force to create sharp cutting edges to butcher carcasses but these, identified as eoliths by some archeologists, cannot reliably be distinguished from naturally splintered pebbles or rocks. There is no evidence that for about 1.5-2.0 million years the early australopithecines could manufacture stone implements. About 2.7 m.y.a., either the late australopithecines or *Homo habilis*, developed the skill of flaking simple Oldowan tools with cutting edges (Fig. 9-17). This may have granted them advantages in the struggle for survival but life remained for long time very hazardous, as suggested by the claim that as many as 15 different hominid species existed between 4.0-1.0 m.y.a. (Cameron, 2003).

Culture of the Late Australopithecines and Homo Habilis: The Early Paleolithic. There must have been great evolutionary pressure on the australopithecines to develop improved defensive and offensive strategies to better compete with the great predators and procure animal nutrients in sufficient quantities. The operation of this selective force would have led to the replacement of the smaller brained, less intelligent early australopithecines by larger brained and more intelligent hominin species using improved tools and more efficient hunting and scavenging strategies. This hypothetical behavioral modification has been referred to as “confrontational scavenging” (Plummer, 2004).

CONFRONTATIONAL SCAVENGING. The large quantity of Oldowan tools found at some Early Paleolithic sites (Leakey, 1971; Isaac, 1989) suggests that by the Early Paleolithic some of the scavenging parties were of considerable size. A well organized large group of braves might have descended on a pride of lions or a pack of wild dogs that just made a kill, and forced them to abandon their quarry by pelting them with stones and hitting them with clubs. It is important to note in this context that the Oldowan cores produced by the late australopithecines and *Homo habilis*, and the flakes obtained as a byproduct, were not weapons. The flakes were suitable as knives for butchering and scraping carcasses, and the cores as choppers for breaking bones to get the marrow, and pounding the tough flesh to make them more palatable. If so, the Early Paleolithic nomads must have continued to use round pebbles and cobbles as projectiles, and sticks and wooden clubs or long bones for routing carnivores but lacked weapons to themselves engage in large game hunting. A band of biped hominid males could take possession of a large quarry after carnivores killed a deer or a wildebeest by descending on the carnivores and routing them. Although lions and leopards are experienced in protecting their spoil from scavengers like hyenas that attack in a familiar style with bared canines and claws, they would not have known how to fight these strange intruders, running on their hindlimbs and hurting and injuring them with unfamiliar weapons. The fear that these carnivores developed may have been like what lions display when attacked by Maasai warriors, or in a circus where the trainer periodically uses his whip to remind them of the pain he can inflict.

Did the Early Paleolithic hominids undertake long distance scavenging forays? Hunters in primitive societies tend to carry to their home base select parts of the quarry that contain plenty of meat and fat (e.g., thighs rather than ribs), particularly if they have to travel far (White et al., 1955; Binford, 1978; Bunn et al., 1988). That is, as transport distance increases there is incentive to cart only the choicest parts of the carcass. Hence, the relative abundance of certain

skeletal elements at an archeological site can be used to infer how far the butchering site was from the home base (O'Connell et al., 2002). There is an earlier report that instead of carting an entire carcass, hominids carried select pieces of a prey to their home base (Bunn, 1986). However, according to a recent investigation of carcass transport at Olduvai Gorge, there is no evidence for selective transport of select pieces at older stratigraphic levels; clear evidence for that was obtained only at sites dated to 1.85-1.75 m.y.a. or later (Faith et al., 2009). This suggests that the earlier hominid occupants of the site did not undertake long forays from their home base to scavenge, as did the more advanced hominin species.

GENDER-BASED DIVISION OF LABOR. Once an organized band of males could procure large quantities of meat in a single foray, it could return with the quarry to provision their women burdened with children left behind at a home base. The women, in turn, could use choppers to mince the meat the men supplied, and grind the grains and tubers they themselves collected, to make them easier to chew and swallow. That may have started a new culture pattern, the development of a gender-based division of labor with the women engaged in domestic work and caring for the children, and the men turning into militant fighters.

THE CULTIVATION OF MALE BRAVERY AND SAVAGERY. Changing from stealthy to confrontational scavenging, the hominids gradually became efficient exploiters of the rich resources of the savanna. The paradoxical shortening of their muzzle (compare Figs. 9-3 and 9-10) supports this inference. This anatomical change is paradoxical because life in the savanna was far more hazardous than in the forest, and biped locomotion did not improve running speed when pursued by predators and would have hindered the hominids' facility to climb up trees, as apes do, when threatened. Why, then, did the hominids lose their large canines when they had to defend themselves and compete with the stronger and faster lions, tigers, hyenas, and wild dogs? And why did their jaws become less powerful when life in the grasslands required a shift from reliance on soft nutrients of the forest (fruits, berries, honey, termites, etc.) to crunching hard cereals and chewing tough tubers and meat? This paradox can be resolved if we postulate that gradually the hominids shifted from opportunistic scavenging by a few individuals to planning and organizing larger scavenger parties. Some time ago, Ardrey (1976) offered his "hunting hypothesis," arguing that the australopithecines developed a cooperative "bipolar society" in which domestic chores (caring for the young, collecting plant food, chopping cereals and mincing meat) were delegated to the females and the males became "killer apes," hunters with the responsibility of subduing large game, carry their kill home, and provide the group with an ample supply of meat. While the australopithecines lacked suitable weapons—such as spears and arrows with hafted stone points—to become large-game hunters, they could engage in confrontational scavenging by cultivating bravery and savagery as an emotional disposition.

Affective, Mnemonic and Rational Advances of the Early Paleolithic Hominids. The hypothesis of offensive scavenging implies two affect-based developments. First, the hominids gradually became courageous and savage fighters to be able to route powerful carnivores. Second, that they became generous enough to return with the quarry to their home base to provision their dependents. Timid individuals could not face, let alone attack lions and tigers even if they had sticks and stones, and uncaring individuals would not have bothered to cart their quarry to their home base to provision their women and children.

AFFECTIVE EVOLUTION: THE INTENSIFICATION OF PUGNACITY AND GENEROSITY. Moving from the relatively safe montane environment to the hazardous savanna, naturally aggressive and savage individuals acquired advantages over those with a less violent temper, and that would have led to a selection pressure that favored the survival of more pugnacious individuals. It is also possible that a tradition evolved that sought to inculcate bravery and ruthlessness in the young. But because this new way of life also depended on group solidarity and cooperation, as well as sharing, there was also social pressure that fostered the evolution of a culture of generosity and mutual aid. This mental and cultural transformation was necessitated by the premature delivery of offspring with increasingly larger heads before their brain was sufficiently mature to enable the neonate and infant to cling to its mother's belly or ride on her back, as chimpanzees and other apes do. The encumbered nursing mother either had to stay behind with her young at a secure home base or carry her young, in both cases becoming handicapped in defending and provisioning herself. Hence, the women became dependent on unencumbered men to provision them with highly prized meat. The domesticated women, in turn, could help the males by collecting vegetable nutrients and take full responsibility for domestic chores, such as preparing (chopping, mincing, powdering, etc.) the food that the men brought to the home base. Did the small hominid bands abandon the promiscuous sexual relations of chimpanzees by developing the institution of marriage? While that would have mitigated competition between the males of the group for females and, in turn, aided the maintenance of peaceful relationship and camaraderie among the fighters, the hominids may not have been sufficiently advanced rationally to develop that cultural institution.

MNEMONIC AND RATIONAL ADVANCES. There is a line of indirect archeological evidence for cognitive advances among Oldowan toolmakers relative to the early australopithecines. First, they selected crystalline stones (flint, quartz, chert, etc.) which, when struck with the proper percussive force, produce a conchoidal fracture, a split surface with a razor sharp edge and a swelling, called bulb of percussion (Isaac, 1986; Semaw et al., 2003; Toth and Schick, 2009). To gather stones that fracture this way may have required a planned excursion to sites where they could be found; indeed, there is evidence from several archeological sites that raw materials were collected and transported to working stations over long distances (Leakey, 1971; Potts, 1984, 1988; Isaac, 1986; Wynn, 1999; Plummer, 2004). Second, the steps involved in producing stone tool requires training – a suitable stone has to be held firmly in one hand and struck with another stone serving as a hammer with accuracy to deliver the appropriate percussive force; as it has been reported, stone tool production is an expert skill even for modern humans (Toth, 1985; Nonaka et al., 2010). Third, it is likely that at those sites where large quantities of Oldowan choppers have been unearthed, the work may have been a cooperative task, with some individuals locating and visiting sites where suitable pebbles and cobbles were available, and others who worked as expert knappers at a home base. These technical skills, and the planning and execution of successful offensive scavenging forays imply advances in mnemonic and rational abilities.

DID THE AUSTRALOPITHECINES USE LANGUAGE? There are skilled and cooperative activities that group members can accomplish by social facilitation without discussing and agreeing upon a plan of action. The chimpanzee alpha male hungry for meat may emit a call that signals to the other males that it is time to go hunting, and the others may follow him and engage in a

haphazard foray without any forethought or preparation. The organization of confrontational scavenging by the hominids, and the butchering of the quarry and returning with the yield, would have been different, requiring the assembling of weapons and butchering implements, and an organized plan of action. How did the hominids communicate with each other? We have currently no direct evidence bearing on this question. But it is reasonable to assume that they began to use a primitive declarative language, one that enabled the skilled and knowledgeable members of the community to instruct the others how to prepare and execute an expedition.

THE HYPOTHETICAL HOMINID PROTOLANGUAGE. Wild chimpanzees use gestural and vocal expressions to communicate their desires, intents and moods to each other. However, they do not converse with one another in the sense of giving or asking for instructions, let alone discoursing about their past experiences or future plans. We have argued earlier that chimpanzees lack the ability to form abstract concepts of temporal, spatial and causal relationships among things and assign words to them. Did the early australopithecines have a language? To assume that they did, we need material evidence that they produced or accomplished things that could not be done without talking. There is currently no evidence for language in the early australopithecines, since they produced no artifacts. However, it may be argued that more advanced hominids that produced tools and engaged in scavenging expeditions used a protolanguage.

As noted, stone tool production requires locating and collecting suitable raw materials, and their production in sufficient quantities requires cooperative effort. These technical tasks require communication in the form of an expert giving verbal instructions to his helpers. In its most elementary form, these technical instructions would not have required a grammatical language or abstract words, only what might be called a protolanguage with words for specific objects, specific actions, and simple qualifiers. A hypothetical instruction by an expert to his assistant might have been: *go river get small cobbles*; or *go mountain get large rocks*. A phrase like this is composed of words the meaning of which could have been communicated by pointing to and naming the referenced objects (river, cobble), and indicated by gestures to the properties of the objects (small, large) and the actions involved (go, get). The expert instructing his assistant how to produce a chopper might have accompanied his demonstration of what hammer to use and the angle and power of striking by using simple abstract terms like *yes* or *no*, *this way* or *that way*, *harder* or *easier*. Planning a scavenging or hunting expedition on the following day would have necessitated simple relational terms, such as *tomorrow* and *morning*, with some members getting next day the instruction “*run to water when me yell*,” others “*hide wait till me lift hand*.” In line with our earlier distinction between sketchy and ideational concepts in interpreting chimpanzee reasoning (Section 8.3.6), we suggest that the hominids of the Early Paleolithic used a pidgin-like language that consisted of words that refer to concrete objects and actions, and their simple properties and relationships; i.e., referents that can be overtly (physically) pointed to, mimicked and enacted, and covertly (mentally) visualized, portrayed or sketched. In the absence any evidence that the australopithecines decorated themselves, produced works of art (such as amulets) or engaged in ritual practices (such as burying their dead), there is no reason to assume that they engaged in thinking or reflection that generate and require abstract concepts, such as *pretty* or *ugly*, *kind* or *unkind*, *honest* or *dishonest*, *good* or *evil*, *sacred* or *profane*, *true* or *false*, *factual* or *imaginary*.

THE RATIONAL LIMITATIONS OF THE EARLY PALEOLITHIC HOMINIDS. That the intelligence of the Early Paleolithic hominids was imitative (mnemonic) rather than inventive (rational) is suggested by the fact that the Oldowan technique of tool production endured from about 2.6 m.y.a until about 1.6 m.y.a., with relatively little variability over place and time. Most Oldowan tools have a simple design with a few cutting edges on a more or less flat surface (Toth, 1985; Roche et al., 1999; de la Torre et al., 2003; Semaw et al., 2003; Delagnes and Roche, 2005; Stout et al., 2010; Fig. 9-17), a design that does not require sculpting, only a knowledge of the fracturing characteristics (stress lines) inherent in the stone and the skill to deliver a few well-aimed strikes (Nonaka et al., 2010). This has been referred to as the “least effort” method to produce a tool with sharp edges, or Mode 1 (Clark, 1977); its endurance for about 1 million years is referred to as the “Oldowan technological stasis” (Semaw et al., 2003; Stout et al., 2010). These hominids did not produce tools of a particular shape, that require a clear idea (mental template) what the product should look like, and the skill to deliver a series of successive strikes with measured force to get small faces of a particular size and angle. That ability was not acquired until the end of the Oldowan period, and was not fully developed until *Homo erectus* with a much larger brain, produced Acheulean (Mode 2) bifacial tools (Figs. 9-18, 9-19).

The preservation of a standard method of tool production for such a long a period suggests that after the technique was developed by some inventive individual or group, it was adopted by less advanced groups and less talented individuals who faithfully imitated an established cultural tradition. Two other findings are indicative of the intellectual limitation of the small-brained australopithecines: their failure to leave Africa and colonize the fertile valleys in the temperate zones of Asia, and the apparent absence of a non-utilitarian (“spiritual”) culture. The australopithecines remained confined to their original birthplace in tropical and subtropical Africa, presumably because they lacked the inventiveness to turn animal skins into garments and make fire to keep warm in colder climates. And there is currently no evidence that they engaged in such non-subsistence activities as decorating themselves with shells or beads, producing works of art, or engaging in such religious practices as burying the dead. If it is correct that they used no clothing, and only had a language with a small vocabulary of concrete words, they may have remained furry creatures and their socialization may have continued to be based on mutual grooming rather than reminiscing, gossiping and telling of tales.

9.4.4. Hominin Cultural and Mental Evolution: *Homo Erectus* and *Homo Heidelbergensis*. Paralleling the expansion of the brain of *Homo erectus* and *Homo heidelbergensis* (Fig. 9-12) during the period known as the Middle Paleolithic, hominin culture was marked the technical ability to producing symmetrical bifacial Acheulean hand axes (Bordes, 1961; Oakley, 1961; Sheratt, 1980; Binford, 1983; Isaac, 1984; Klein, 1999). We now turn to inquire what advances these hominins might have made in the cultural domains that left no material evidence, such as language use, social organization, and the production of objects of art and ritual.

Technical Advances of the Middle Paleolithic Hominins. According to current evidence (Fig. 9-13A), *Homo erectus* left Africa about 1.8 k.y.a., reached the warmer zones of Asia soon

thereafter, and the cooler zones of Europe by 500 k.y.a. (Out of Africa I). This dispersal and colonization of Eurasia, presumably by bands of hunters following herds, is inconceivable without assuming that they produced improved hunting weapons, and knew how to light fire and make clothing to keep warm at night and survive through the cold winters.

THE IMPROVED ACHEULEAN AND MOUSTERIAN STONE TOOL TECHNIQUES. Simple Acheulean hand axes first appeared in Kenya about 1.7 m.y.a., and soon spread from there to Asia presumably as the handiwork of *Homo erectus*. More advanced symmetrical bifacial handaxes were produced at several sites by about 500 k.y.a. (Fig. 9-19). The next advance in tool production occurred about 300 k.y.a., with the invention of the Levallois or prepared core technique (Fig. 9-20). The latter may have been the handiwork of the larger brained *Homo heidelbergensis* (Fig. 9-12). This stone tool production technique (Mode 3) indicate considerable advance not only in manual skill but also in reasoning power, as they require a production plan consisting of several steps: striking a suitable rock with a stone hammer and chisel to get a blank of a specific form, then use a soft hammer to sculpt it and, finally, finish it by pressure flaking to give it a trimmed appearance (Fig. 9-20). As a discovery in Germany indicates, *Homo heidelbergensis* crafted wooden spears (Thieme, 1997), which implies that he could have been an effective hunter. The robust *Homo neanderthalis* of Europe and the Levant, possibly cohabitants with or descendants of *Homo heidelbergensis*, is associated with a new lithic industry, the Mousterian (Fig. 9-21). Mousterian-style tools, which appeared in Africa and Europe about 250 k.y.a., are characterized by the production not only of bifacial handaxes but also specialized tools with different shapes and features (Bordes, 1961; Springer and Gamble, 1993; Wynn, 1999; Klein, 1999). Short blades were turned with a few strikes into sharp points (Figs. 9-21A, B, C), and were presumably hafted to spears to hunt large game. The binding material of these compound artifacts was plant twine, with resin used as an adhesive (Lombard, 2005). Long blades produced with the Levallois technique as blanks (Fig. 9-20D-F) were turned into special purpose tools, such as knives with sharp edges for cutting skin and meat; scrapers for dressing animal hides to make clothing or to serve as tent covers; wedges, burins, denticulates and notched or serrated blades for splintering, sawing, whittling, shaving and drilling wood (Fig. 9-22). This diversity of stone artifacts also suggests increasing technical specialization, such as preparing fur and leather and making garments, and using long distance projectiles (Brooks et al., 2005). These stone tools, whether simple or elaborate, must have been the handiwork of well-trained specialists who followed standardized procedures.

THE INVENTION OF FIRE MAKING. Most animals dread forest fires but it has been reported that chimpanzees calmly monitor the spread of wild fire and modify their behavior accordingly (Pruetz and LaDuke, 2010). Experimental studies indicate that apes prefer most nutrients cooked rather than raw (Wobber et al., 2008). Hominins may have discovered early in their career that a scorched area often contains roasted nutrients that are more tender and palatable than in their raw form. The high metabolic cost of sustaining a large and active brain, and the necessity to provision dependents, put pressure on hominins to procure calorie-rich nutrients in adequate quantities. Cereals, tubers and venison meet this requirement but they are difficult to chew and digest, and not always appetizing. Baking tough and fibrous carbohydrates turns them into palatable sugars and makes meat tender and more appetizing (Wrangham et al., 1999). In addition to its nutritional benefits, fire makes life safer and more comfortable: it

keeps away wild animals and insects, provides light and warmth, and facilitates socializing after sunset.

Logical considerations suggest three stages in the evolution of fire use and its production: (i) collecting burning or smoldering wood or undergrowth lit by lightning, and stoking it to keep the flame going; (ii) making dry grass or kindling catch fire by drilling dry wood or striking two pieces of flint together to produce sparks; and (iii) keep fires going either by building outdoor pits or a hearth inside a dwelling. It is not known when hominins began to use fire opportunistically, perhaps by visiting sites with smoldering wood or vegetation and carrying embers to their home base. Determining deliberate use of fire is problematic because ashes and burnt bones found at some sites could have been produced by wildfire (Clark and Harris, 1985). However, it has been reported that a 1.5-1.0 m.y. old cave in South Africa contained burnt bones heated to the high temperature typically produced by campfires (Brain and Sillent, 1988). Recently convincing evidence has been obtained for burnt bone and plant ashes in a South African cave, dated to about 1.0 m.y.a. (Berna et al., 2012). This would support the inference that *Homo erectus* used fire. At a site occupied by hominins 790 k.y.a. in the Levant, evidence for fire use was obtained together with hand axes, wooden tools, and the bones of animals and fish (Goren-Inbar et al., 2004; Alpers-Afil et al., 2009); at another site burnt bones with cut marks were dated to about 380 k.y.a. (Karkanas et al., 2007). The earliest hearths in Europe, discovered at Terra Amata in France, were dated to about 400 k.y.a. (de Lumley, 1969), and perhaps somewhat earlier at Torralba and Ambrona in Spain (Tattersall, 1995). Evidently, by this time the intentional use of fire was an established cultural practice.

THE INVENTION OF GARMENT MAKING. Another cultural development of great significance has been the preparation of animal skins and making of garments. The primary use of clothing is to protect the body from wind and cold, rain and snow. That protection is optional in the tropics, imperative in colder climates. Protective clothing may also be worn to reduce injury by weapons, and for display, such as wearing headgears, furs with distinctive colors or markings, etc., as symbols of status, power, and wealth. In terms of its origins, the simplest of garments were probably untailed animal hides wrapped around the body. But since hides are perishable, direct evidence of their early use is not part of the archeological record. However, implements used for their preparation would survive, and it has been claimed that stone tools particularly adapted for scraping hides were present at European sites as early as 780 k.y.a. (Carbonell et al., 1999). An indirect approach to date the invention of clothing has been the attempt to determine when lice that thrive in clothing evolved from an ancestral form that infested all parts of the hairy body of primates (Kittler et al. 2003). The louse adapted to modern humans (*Pediculus humanus*) exists in two forms, one infesting the hairy head and another the garments worn on the hairless body. The latter, it is argued, would not have evolved until humans began to regularly wear clothing. A recent genetic investigation suggests that the cloth louse may have diverged from the head louse about 170 k.y.a. (Toups et al., 2010).

GARMENTS AND THE EVOLUTION OF NAKEDNESS. Most primates are covered by heavy fur but humans are naked, except for some hairy parts of the body as secondary sex characteristics. There are several hypotheses as to when and why nakedness has evolved in humans, beginning with Darwin's theory of sexual selection. A convincing hypothesis is that hairlessness evolved

primarily as a strategy to combat ectoparasites (Pagel and Bodmer, 2003). The fur of monkeys and apes may be infested with lice, fleas, ticks, and mites, and most primates spend considerable time and effort in grooming themselves and one another. The wearing of animal skins over long periods (perhaps a lifetime) may have exacerbated the danger of fur infestation, particularly because grooming had to be abandoned if the body was covered. Moreover, wearing clothing had the added benefit that it could be readily changed or removed in accordance with prevailing environmental conditions. Finally, once hairlessness has evolved, it led to the development of enhanced personal relationship through the intimacy created by mutual touching, holding hands, caressing, and massaging.

THE CONSTRUCTION OF SHELTERS. There is no evidence that the hominins used enduring materials, such as stones, and sturdy poles that needed large holes in the ground, to build solid shelters. The nomadic life style of hunters, who followed migrating herds, would have made it more practical to use light materials that could be carried from one site to another and quickly assembled as a shelter. Nomads may have had favored home bases to which they returned periodically, and there is archeological evidence for prolonged occupation of caves, rock overhangs and riverbanks. An example is the recent report of a home near an ancient river at Gesher Benot Ya'akov, Israel, dated about 750 k.y.a., with remains of fireplaces, where hominins used a distinct area for stone knapping, and another for the processing and consumption of food (Alperson-Afil et al., 2009). This suggests that hominins erected larger dwellings consisting of a shop and a living area at some locales.

The Dawn of Spirituality During the Middle Paleolithic. We use the term “spirituality” in the sense of activities engaged in and products manufactured that do not directly serve *organic* needs but satisfy *ideational* motives. One of these was the *aesthetic* impulse to embellish oneself and one's habitat, which led to the emergence of ornamental and decorative art, and celebrations such as singing, dancing and making music. The other was the *epistemic* endeavor to comprehend what transpires in the outside world and gain some control over it. Wonder and reflection in the absence of much empirical knowledge, initially led to the creation of an imaginary world animated by dangerous and treacherous ghosts and spirits, which led to such behavioral practices as engaging in magic and rituals.

EARLY AESTHETICS AND ART PRODUCTS. We have argued earlier (Section 9.3.7) that some of the finely wrought Acheulean tools may have been designed as luxury items, perhaps acquired and displayed by hunters and warriors as badges of status or honor, much like dignitaries of more recent times parade with precious daggers, swords, or pistols. Another indication of the emergence of an aesthetic impulse is the use of ochre, presumably as a body paint, as early as 500 k.y.a., and more regularly by 300 k.y.a. (Barham et al., 2002). That practice may have been initiated by *Homo heidelbergensis*. A small pebble found at Berekhat Ram in the Golan Heights, and dated to about 230 k.y.a. may have been a simply wrought female figurine (Fig. 9-28A); the “Venus of Tan-Tan” (Fig. 9-28B), discovered in Morocco and dated to between 500-200 k.y.a., is undoubtedly that. However, with the exception of these rare items, there is little evidence that these hominins routinely produced enduring art works. These become more common with the emergence of humans that we have characterized as supracephalic archaic humans (Table 9-1). Pigment was used at a 160 k.y.a. site in Africa (Marean et al., 2007), and

at a 92 k.y. old site in Israel (Vandermeersch, 1969; Bar-Yosef Mayer, 2009). Perforated shell beads, perhaps used as a necklace, together with engraved ochre were unearthed at a somewhat later date in Africa (Fig. 9-29).

DID THE NEANDERTHALS PRODUCE WORKS OF ART? Suggestive that the Neanderthals had an artistic culture is the report of red ochre and sea shells in the caves of Skhul and Qafzeh at Mount Carmel in Israel, dated to about 100 k.y.a., in association with Neanderthal skeletal remains (Belfer-Cohen and Hovers, 1992; Hovers et al., 2003; Bar Yosef et al., 2009). The pierced shells found at at Blombos Cave in South Africa, dated to 75 k.y.a., and the chunks of ochre with geometric engravings (Fig. 9-29) may have been the work of modern humans (d'Errico et al., 2005; Henshilwood et al., 2009). Recently discovered simple drawings in a cave in Andalusia, tentatively dated to about 43 k.y.a., has been attributed to Neanderthals (Sanchidrián, 2012). It has also been reported that Neanderthals produced a primitive bone flute as a musical instrument at a Slovenian site about 43 k.y.a. (Turk, 1997) but that identification has been disputed (d'Errico et al., 1998). Unambiguous flutes made of ivory and bird bones of about the same antiquity have recently been discovered in a cave near the Danube in Germany (Higham, 2012). The authors suggest that the flutes were the work of early *Homo sapiens*. It is reasonable to assume, however, that before flutes were manufactured, hominins engaged in music making by singing, dancing, clapping hands, drumming on logs, using rattles, and the like.

EARLY RELIGIOUS RITUALS: DID THE NEANDERTHALS BURY THEIR DEAD? Suggestive of Middle Paleolithic morality is the Neanderthal skeleton found in a grave at Chapelle-aux-Saints (Trinkaus, 1985). It was identified as a 40-50 year-old male who was crippled with arthritis and only had two teeth. Since he could not walk and needed soft nutrients, he was presumably cared for by his family. Similarly a man buried at Shanidar Cave crippled with degenerative joint disease, a withered arm and blind in one eye reached the age of the average Neanderthal (Stewart, 1977). While there is no evidence that the Neanderthals ever dug deep pits to bury their dead, the recovery of several complete skeletons in various locations indicates that the dead were intentionally buried and the grave was covered with dirt or stones to prevent access by hyenas and other scavengers. In a few instances, the dead seem to have been put to rest in a fetal position, and it has been argued, though not proven, that in one case a buried man's body was sprinkled with flowers (Solecki, 1971). There is also some evidence for rites associated with burials. In the caves of Skhul and Qafzeh at Mount Carmel in Israel, the skeleton of a Neanderthal man was accompanied by grave goods, not only red ochre and sea shells but also a deer antler (Fig. 9-33A). In the nearby Kebara Cave, a buried partial skeleton of a Neanderthal man, dated to about 60 k.y.a., was accompanied by stone tools (Fig. 9-33B). The cut marks on some of the human bones, indicating removal of the flesh, may reflect ritual practice or cannibalism (Defleur et al., 1999).

In summary, the available evidence indicates that *Homo heidelbergensis* and *Homo neanderthalis* adapted themselves successfully to the harsh conditions that prevailed in Eurasia during the Ice Ages. They were endowed with great physical strength, were capable of producing effective tools and weapons to kill and butcher large animals, used hides to keep warm, and sheltered in caves during the cold seasons. As nomads following herds, they never

seem to have built enduring settlements or form complex tribal organizations, and began to develop an elementary form of spiritual life. When, about 40 k.y.a., a swifter, more agile and intellectually more advanced African species of modern humans invaded Eurasia, the Neanderthals succumbed and became extinct about 30-25 m.y.a.

9.5. The Contributions of Anthropology to our Interpretation of Human Cultural and Mental Evolution

9.5.1. *The Anthropological Perspective on Human Mental Evolution.* In seeking to interpret the culture and mentality of peoples of the Late Paleolithic, Mesolithic and Neolithic, it is appropriate to turn to anthropology since in both cases we deal with the same human species, *Homo sapiens*. In combination with the archeological evidence, anthropological descriptions and analyses of the way of life and mindset of primitive (preliterate) hunters and farmers can be fruitfully used to reconstruct the social and spiritual evolution of long extinct humans.

THE TRANSITION FROM ANIMALS TO HUMANS. When did our ancestors, the apes, become humans, and when did our human ancestors become persons like ourselves? The chasm between animals and humans is not a trivial one. Apart from the fundamental difference that we use articulated language to think and communicate with one another and animals do not (a subject that we shall discuss separately), much of our conduct is motivated and regulated by cultural factors, which is absent in animal behavior. (i) We differ from animals *behaviorally* in that much of what that we do or abstain from doing is governed by moral principles of right and wrong, and mores of what is decent or indecent. When in the company of others, we share food with them rather than gobble it ourselves. When we need to relieve ourselves, we do that in private, not in public. (ii) We differ from apes *socially* by obeying principles and conventions that specify our role within the group, such as being a father or a mother, teacher or pupil, carpenter or locksmith, master or apprentice, employer or employee. (iii) We differ from apes *technically* in that we produce and use artifacts, such as utensils, clothing, tools and vehicles. (iv) We differ from apes *intellectually* by consciously reflecting upon how we live, what we do and what goes on in the world, and entertain artistic preferences, religious beliefs and scientific theories. How and when did this momentous transformation take place? While we do not have a full answer to this question, available anthropological descriptions and analyses of primitive peoples, who lived outside the sphere of influence of our advanced technical and scientific culture, are a rich source of information about the advances of humanity. Indeed, some of these primitive societies of hunters and tillers closely resemble the Late Paleolithic and Neolithic cultures, respectively, that we know only from their archeological remains.

We consider first anthropological theories of man's mental and cultural evolution, and follow that by a brief description of the culture and mindset of societies selected in roughly an ascending order of complexity.

9.5.2. *Culture and Mental Development: The Role of Institutions, Conventions and the Social Order.* We differ from apes not only by having larger brains and superior reasoning ability but also by being born into and reared in a cultural milieu. Unlike animals whose

behavior is motivated principally by organic needs and abilities, human conduct is greatly influenced by cultural institutions, conventions and the social order. What we do and what we strive to accomplish are fashioned by the conditions of our early nurturing history, our subsequent education and training, and by the social conditions that foster or hinder our development and self-realization. Culture as a collective heritage and mind as an individual ability are interdependent because not only does culture mold the mind, its endurance depends on the assimilation and propagation of its norms and values by mentally competent individuals. Moreover, culture is not a static entity, it changes and evolves because of the unceasing contributions that hard working and thoughtful productive and innovative individuals are making. In that sense, culture is a product of the human mind. We cannot understand the evolution of the modern mind—the great advances in science and technology that have taken place in recent millennia—by simply considering brain evolution. There is no evidence that the structure of the brain has changed much since the time when *Homo sapiens* colonized most of the globe about 45 k.y.a. and gave rise to societies that are similar in some respects and different in others. Our large brains and our advanced reasoning powers are necessary but not sufficient determinants of who we are, what we do, and what we endeavor to achieve.

THE ROLE OF CULTURE IN MOLDING MENTALITY. Before the discovery of the Americas, most Europeans were familiar only with the life style, morals and belief systems of their own kind, perhaps with some superficial knowledge of the customs and habits of such “pagans” as the Moors of Spain, the Saracens of Turkey, and the occasional African native who reached a Mediterranean harbor. Although they used different languages, most Europeans worshipped the same divinity, performed similar rituals and ceremonies, lived in the same sort of dwellings, used similar tools and weapons, and, above all, had the same notions of what is proper or improper, right or wrong, virtuous or evil. Therefore, conduct in conformity with Western standards was considered “natural.” It was thought to be part of “natural law” to be monogamous, appear dressed in public, believe in one God, and the like. Hence when the first explorers and colonizers encountered dark-skinned natives who lived differently—wore little or no clothing; painted and decorated their faces and bodies; used primitive tools and weapons; engaged in premarital sex; had multiple husbands or multiple wives; practiced magic and used exotic rites and rituals, and so forth—they assumed that these people were an inferior human species, fundamentally different from themselves. This belief justified the appropriation of their lands, their exploitation and enslavement. The great contribution of the anthropologists of the 19th century, in contrast to the conquerors and colonizers, was the realization that these natives were not mentally inferior to Europeans but only culturally different. Some anthropologists expressed this new view by referring to “the psychic unity of mankind” (Tylor, 1871; Morgan, 1877). By the 20th century, it was generally accepted that the differences between primitive and civilized peoples was not due to inherited biological differences but to cultural development (Boas, 1911; Murdock, 1934; Linton, 1936; Boas, 1938; Malinowski, 1944; Herskovits, 1948; White, 1959; Steward, 1955; Service, 1975; Johnson and Earle, 2000; Carneiro, 2003). The anthropologists argued that the simpler life style of the native tribes of Australia, Africa and the Americas was due to their less developed technical expertise and simpler social organization—i.e., cultural factors—rather than mental inferiority. And analyzing the similarities and differences in the social organization and belief systems of people in different cultures, the concept of “culture patterns” (Benedict, 1934) or

“culture configurations” (Kroeber, 1969) was developed. Using mental terms, Ruth Benedict (following Nietzsche) described some cultures as Dionysian—frenzied, liable to excess, daring and aggressive; others as Apollonian—placid, moderate, timid and defensive. Living in the Northwest Coast of America with an abundance of high quality nutrients (fish, birds, seals, whales), the Kwakiutl Indians developed a boisterous and extravagant culture, with such excesses as the potlatch ceremony. In contrast, the Hopis of the Southwest Desert who made their meager living by cultivating maize, beans, and squash with great effort, developed a sober and serene culture.

CULTURE UNIVERSALS AND CULTURAL VARIABILITY. The anthropologists of the 20th century have established that there are cultural universals as well as considerable cultural variability. Irrespective whether primitive or advanced, as members of the same species, *Homo sapiens*, we all share the following traits: use a grammatical language to communicate with one another; are raised in a family setting; are members of some social group; use man-made artifacts; have ideas of how to adorn ourselves; and we are all expected to live by a set of moral and religious principles. For this reason, language, marriage, social organization, technology, fashion, morality and religion are called culture universals. However, cultures are not uniform. Although the use of speech is an inborn disposition, the words we use are of conventional origin and people living in different culture areas have to learn the distinctive regional language how to communicate with one another. Marriage is a cultural universal but the rules that govern the nexus between husband and wife, and the kinship system that determines the relationship between families vary widely. All humans are members of a social order in which individuals play an ascribed role, but the size and complexity of societies vary greatly from one culture to the next. All humans make and use tools and weapons, and have the technical expertise to exploit environmental resources and defend themselves and their dependents, but they vary greatly in the kinds of tools they make, in their economic activities, and how they defend themselves. All cultures have rules of etiquette and moral principles, which regulate personal conduct and social relations, but there is variability in what is considered decent or indecent, beautiful or ugly, right or wrong. Finally, all cultures have a religion, which aids the individual to cope with the vicissitudes of life and contributes to communal solidarity and social order, but there are profound differences in what people believe in and in the rites and rituals they practice.

VARIETIES OF MARRIAGE, FAMILY AND KINSHIP SYSTEMS. Man’s closest animal relation, the chimpanzee, is promiscuous and several males in succession copulate with an ovulating female, sometimes virtually all the males of the troop (Watts, 2007). Hence, paternity is unknown and the mother nurtures and guards the young by herself without help from the father (Silk, 1978). The mother’s task is aided by the infant’s ability to cling to her belly when she moves about. As the infant’s locomotor coordination improves by about 6 months of age, it climbs onto its mother’s back as she travels and rides in a “jockey” position. The human infant can do none of that. It is incapable of moving about for several months after delivery, does not begin to crawl until about 8 months of age and walk until about 12 months, and only becomes a proficient walker at about 15 months (McGraw, 1943). This handicap is due to the fact that the human neonate is delivered at a developmental stage when its cerebral cortex and the corticospinal tract (which control voluntary locomotion) are still unmyelinated and nonfunctional (Altman

and Bayer, 2001). This premature delivery is a biological necessity because the neonate is destined to develop a large forebrain but its head cannot exceed the size of the pelvic opening at birth. The pelvis, which articulates with the thigh bone (the femur), must remain narrow to allow effective biped locomotion; the result is a small opening. Hence the offspring is born during a fetal stage before the head becomes too large. The neuromuscular immaturity of the neonate burdens the mother considerably, and her need for support set the stage for the development of marriage as an institution during human evolution.

While marriage does not guarantee, or even require a monogamous relationship, in all societies the wife is expected to grant her husband exclusive sexual favors in exchange for his assuming responsibility for provisioning her and their joint offspring. The institution of marriage established a gender-based division of labor. It obligates the husband to go hunting, fishing, cultivating the land, acquire a trade or profession in order to share what he earns with his wife and their dependents; and it obligates the wife to take care of the children and take charge of all the domestic chores. The particular rules governing marriage relations have varied considerably in different cultures (Westermarck, 1921). In most primitive cultures, and in some contemporary ones, a man can have several wives, if he can afford to provide for them. In a few cultures, a woman who owns precious land can have several husbands. There is also great variability in how a man acquires a wife, whether by capture, service to parents, exchange between families, parental arrangement, or mutual attraction. There is also diversity in who can marry whom, with exogamy being more widespread, but endogamy not unknown. The prohibition of incest is virtually universal but there is variability as to who is considered a “blood-relation” (consanguineous) and how kinship relations are reckoned (Morgan, 1870; Rivers, 1914; Radcliffe-Brown, 1952). Where an uncle is considered a “father,” an aunt a “mother,” and cousins as a “sister” or a “brother,” sexual relations between them is considered a taboo. Apart from preventing inbreeding, an important function of elaborate kinship systems and exogamy is to establish affinity between different groups of people. One could more easily enter the camp or village of a differing group and negotiate with them to resolve conflicts or ask for help if welcomed by kin.

VARIETIES OF SOCIAL AND ECONOMIC ORGANIZATION. Most primitive peoples investigated by ethnologists were members of a social group that ranged in size and complexity from small clans of kin, to larger tribes of kin and non-kin, to large village communities with a heterogeneous population, to conglomerates of villages. They also differed in their economic systems, the methods used in the exploitation of environmental resources, and in social stratification. As we describe in some detail later, the nomadic Bushmen of the Kalahari Desert of Africa lived in small family and clan groups, hunting animals and collecting plant foods; they did not till the land; and there were no distinction among them in terms of wealth or status. The Australian Aborigines, likewise lived by hunting and gathering but had a far more complex kinship system and tribal organization. There were considerable differences in the economic roles of men, women, uninitiated young men, and elder men of society. The natives of the New Guinea highlands lived in settled villages, cultivated the land, and raised domesticated animals. There were considerable differences in the status and influence of poorer people and those that were wealthy. The Tswanas of Africa, who likewise lived by tilling the land, had their villages organized into larger units, and were ruled by hereditary nobles and a chief.

VARIETIES OF RITUALS AND RELIGIOUS BELIEFS. Explorers and missionaries initially presented the exotic beliefs and practices of primitive peoples as curiosities rather than glimpses into the evolution of religion. However, by the late 19th century, with evolutionary theory as a framework, the comparative study of primitive religions became a subject of serious anthropological investigation. Thus Tylor (1871) argued that studying primitive religion is equivalent to studying Stone Age beliefs, and Frazer (1922) expressed later a similar view. However, Tylor and Frazer came up with fundamentally different theories about the origin of religion. Tylor argued that contemplating such experiences as dreams, visions, and hallucinations, primitive man developed the idea that there are two realms in the world, the material and the spiritual. Visiting a distant land in a dream while lying in a bed, meant that one's soul temporarily left the body; and dreaming a conversation with a dead ancestor meant that its immortal soul returned to pay a short visit. Frazer in contrast, argued that religion began not with a belief in the spiritual world but in magical practices, a sort of pseudo-science whereby man sought to control what goes on in the world. In "imitative magic," such as pouring water on the parched ground, primitive man thought he could produce rain; by "contagious magic," for instance burning the garment of an enemy, he could be killed. Frazer argued that religion emerged later, when instead of manipulating nature by magic, man turned to propitiate the divine powers by prayer and sacrifices. Tylor and Frazer's theories were widely criticized as being too intellectual, based on cognitive processes rather than emotions. Thus, Marett (1914) argued that belief in the existence of a spiritual world was basically of emotional origin, stemming from the feelings of awe, wonder and admiration when witnessing extraordinary, majestic and mighty events. Much later, influenced by Freud's (1928) ideas, Malinowski (1932; 1935, 1948) argued that both magic and religion arose from primitive man's fears and hopes. Studying the beliefs and practices of the Trobriand Islanders, he observed that the natives knew very well how to produce a good crop by careful cultivation, and how to poison fish when fishing in the lagoon. But the natives turned to magic to prevent pests destroying their crop, which they did not know how to control, and performed various rituals before they ventured out to fish in the open sea, hoping to prevent a dangerous swell or storm. In contrast to these psychological explanations, Durkheim (1915) formulated an altogether different theory of the origins of religion. Instead of originating in the emotions and ideas of individuals, Durkheim argued, religion is of collective origin, imposed on individuals by their society. He recognized that religion is an important social institution. Religion does not exist without sacred objects and shamans, temples and a clergy, without a community of believers and worshippers. Religions came into existence and endure because shared beliefs and dogmas unite a people and create that solidarity that societies need to survive. Durkheim postulated the existence of a "collective mind," a mysterious force that unites a people belonging to the same community. In a similar vein, van Gennep (1908) developed the concept of "rites of passage," social practices that aided individuals in their transition from one stage in their life to another. Birth rites were to aid parents to dedicate themselves to the arduous task of raising their children and making them become useful and virtuous members of society. Initiation rites were to help adolescents to make the transition from careless childhood to responsible adulthood. Marriage rites were to help the young couple to learn to appreciate and help one another as a sacred obligation. And mortuary rituals were to aid to console the bereaved and protect them from the resentment or wrath of the dead. Although these are often viewed as rival theories, they are better thought of as complimentary. Religion serves the individual as

well as society, and it becomes manifest in different forms in different stages of an individual's life. The child's religion may be little more than a set of mindlessly performed rituals; the adolescent's religion may turn into a belief in a spiritual world; and the religious belief in another world aids adults to face life's vicissitudes, be it poverty, failure, frustration, sickness, the fear of death or any combination of these.

9.5.3. *Ethnological Descriptions of Societies Analogous to the Upper Paleolithic and the Mesolithic.* To shed light on the social organization, economic life, belief systems and mentality of extinct Paleolithic, Mesolithic and Neolithic cultures, we consider below, in a rough order of increased complexity, descriptions of peoples: (i) in primitive nomadic societies that lived by hunting and gathering, and (ii) those that settled in villages but did not cultivate the land and raise livestock. The next Section deals with primitive peoples that cultivated the land and raised domesticated animals.

The Life Style and Culture of the Nomadic Bushmen of Africa. The lifestyle and social order of the Bushmen of the African Kalahari Desert may represent the simplest human culture that endured until recently (Lee, 1979). The Bushmen, or San, were hunting and gathering nomads without domesticated animals or plants, moving about during the day in search of food and sheltering overnight in rock overhangs or makeshift huts. The social group was the clan, consisting of several related or unrelated families. Both men and women engaged in collecting vegetable foodstuffs and had extensive knowledge of the nutritional, medicinal, recreational, and harmful properties of hundreds of plants. Men typically did the hunting. The boys were trained to become efficient hunters and were not considered adults until they succeeded in killing a large animal, such as an antelope. Using a bow and arrow with a poisoned tip, the hunters injured an animal and followed it, tracking its spoor until the prey collapsed. Or else, they dug a pit near a waterhole, covered it with vegetation and waited until an animal fell into it and then killed and butchered it.

The culture of the San was simple but served their lifestyle well. Clan members equally shared all the food they acquired. Private property, except for weapons, was unknown, and the clan was egalitarian without a headmen. When they had enough to eat on a particular day, they gathered around a campfire and celebrated together. They recited ancient legends, chanted, sang and danced. They wore some decorations and produced high quality rock art, still extant throughout southern Africa. They believed in a multiplicity of spirits and that some of the dead returned to the sky where they originated. The San were superstitious and performed some rituals to produce rain, cure the sick and prevent calamities, but religious rites did not play a major role in their daily life. Growing up together from early childhood, they acquired the same moral norms, aesthetic preferences and beliefs, and learned to help and trust one another. The solidarity that thus develops among them helped to override conflicts that necessarily arise among individuals with different temperamental dispositions.

The Life Style and Culture of the Nomadic Australian Aborigines. The culture of the Australian Aborigines was far more complex. Humans first settled in Australia about 40-50 k.y.a., presumably reaching it by way of the islands of Indonesia (Bowler and Thorne, 1992). Some time after their distribution throughout Australia, a small contingent of them

reached Tasmania, perhaps by crossing a land bridge during the last glacial period or by raft. We first briefly review what is known about the Tasmanian Aborigines, now extinct, and then describe the life and culture of the mainland Australian Aborigines.

THE ABORIGINES OF TASMANIA. When Europeans first encountered the native Tasmanians, there were about 60 tribes living on the island. The tribes consisted of several families that roamed over a smaller or larger territory that they collectively owned (Bonwick, 1870; Roth, 1890; Murdock, 1934; Mitchell, 1955; Ryan, 1966). There was a gender-based division of labor within the tribe. The women collected berries, roots, mushrooms, grubs, insects, birds' eggs and lizards, dived for shellfish, and cared for the children and the sick; the men were hunters. The native Tasmanians had no domesticated plants and animals, and only a few tools, mainly flint flakes with chipped edges and axes with handles. Spears were used as weapons; the bow and arrow was unknown. The favored targets of the hunt were marsupials, such as kangaroos, which the men killed by ambush or by surrounding a herd with a circle of fire and spearing the animal that tried to escape. The tribe stayed at one location for a few days, each family sheltering in a simple windbreak made of boughs and strips of bark, with a fireplace built in front of it, where they cooked and kept warm, then they moved on. Private property was limited to such items as spears, amulets and ornaments, and a few household goods, such as a woven basket and a kangaroo skin that the women used to carry their baby or to keep warm when it got cold. When a young man reached marrying age, he typically abducted a female from another tribe, as exogamy was the norm. While naked most of the time, the women were modest and, once married, fidelity became obligatory. However, some men were polygamous. Social stratification was minimal but some men were recognized as leaders in the hunt or warfare. Trespassing on another tribe's territory was not tolerated and the tribes were potentially in continuous warfare with one another. The aggressors thrust spears and hurled stones at their victims, who defended themselves with flat wooden shields. The killing of an enemy was a cause for rejoicing and celebration.

The natives were described as lively and volatile in nature, living for the moment and caring little about the future. When food was plentiful in the summer, they enjoyed themselves immensely but they did not store any for the next day. Periodically, the tribe engaged in celebrations by singing, beating drums and dancing around the campfire, reenacting martial accomplishments or love scenes. As an expression of their vanity, the men adorned themselves by blackening their faces with charcoal, matting their hair with grease and hung in ringlets, and painting their bodies with ochre. The women used flowers, feathers and necklaces of kangaroo sinews to decorate themselves. The natives made charcoal drawings of animals, people, and geometric figures on bark to adorn their huts. They had some religious beliefs and practices. They believed in nature spirits, such as a thunder demon, that the spirit of the dead survived as ghosts, and engaged in witchcraft. To harm someone, all that was needed is to take possession of something that belonged to him and burn it. When a member of the tribe died, he was accorded ritual treatment. The corpse was placed on a pile of logs and burnt, and the charred bones were buried in a shallow grave. The dead man's spear may have been set next to the grave so that he could defend himself. Through the night members of the tribe chanted in lamentation. Accordingly, they avoided burial sites and refrained from uttering the dead person's name.

THE AUSTRALIAN ABORIGINES. When the British settled in Australia, the native population consisted of about 500 regional tribes, each with up to and over a thousand individuals (Spencer and Gillen, 1927; Abbie, 1969; Maddock, 1973; Mulvaney, 1975; Berndt and Berndt, 1988; Brown, 1997). Members of each tribe spoke a different language or a distinctive dialect. Within each tribe there were clans consisting of a dozen or more individuals that lived, moved and hunted together. The Australian aborigines used more advanced Paleolithic weapons and tools than did the Tasmanians, such as spear throwers, boomerangs, traps, and harpoons. However, they did not cultivate the land or raise domestic animals (except a dog that they must have brought with them to Australia that lacked placental mammals), possibly because the continent lacked plants and animals suitable for domestication. The men hunted marsupials and killed snakes and crocodiles, or fished. The women and children engaged in collecting plants, insects and smaller animals, using digging sticks and carrying woven baskets and wooden platters. Some of the food was eaten raw, others were eaten cooked. Fire was produced by friction with the wood drilling technique. The people feasted when food was abundant, but rarely stored anything, stoically accepting hunger during seasons of shortage. For ceremonial purposes, the men painted their bodies and adorned themselves with feathers and animal skins, the women wore necklaces and armbands. As nomads, the Australian aborigines were constantly on the move, preferably walking naked, carrying only weapons and a few household objects. When the sun went down, they sheltered in easily assembled lean-tos or huts, and sat around a campfire, gossiping, chanting, and reciting traditional tales and myths.

THE AUSTRALIAN ABORIGINAL KINSHIP SYSTEM. What distinguished most Australian tribes from the Tasmanians was a complex traditional kinship system that regulated family, tribal and intertribal relations, and an elaborate, orally transmitted and memorized religious belief system. In our culture, each of us has a biological mother and father, a pair of maternal and paternal grandparents, one or more sisters or brothers, as well as aunts, uncles and close or distant cousins that are related to us either by “blood” (genetics) or “law” (marriage). In contrast, the Australian natives had a much broader, tradition-based kinship system. The mother’s sisters were “mothers” not aunts; the father’s brothers were “fathers” not uncles; “grandfather” and “grandmother” were people of one’s grandparents’ generation; “aunts” and “uncles” were distantly related elderly people of the tribe that deserved respect; and “cousins” were close or distant relatives of one’s own generation. While some of these designations were complimentary, others involved serious social obligations. In sharing food, caring for children, assisting the sick, providing protection, etc., the individual’s obligations were the same to all the “mothers” as to one’s biological mother, and the mother’s obligation to the individual were the same as to the children they bore. Owing to this cultural system, the Australian family was greatly expanded, with mutual aid obligations extending equally to dozens of individuals.

AUSTRALIAN ABORIGINAL SOCIAL ORGANIZATION. Beyond this kinship order, the tribe was typically divided into two moieties, each associated with a different totem or ancestral spirit. The totem of a moiety, which gave it its name, may have been a species of reptile, bird or mammal, or a particular tree or a distinctive rock, and its members were believed to have descended from it or its spirit. Exogamy required that marriage partners come from different moieties; having sexual relations with a member of one’s own moiety was taboo, much as incestuous relations with close kin is in our society. Although nomadic societies

with minimal private property have been described as egalitarian, the social organization of Australian natives was distinctly stratified both in terms of gender and age. Although the food that the women collected represented two-thirds or more of the daily diet, they were obligated to perform most of the daily chores, not only feeding and carrying the children but also carting much of the family's movable property (Hiatt, 1970). And even though they were the backbone of the subsistence economy, the women were totally subjugated to men; they were basically their father or husband's property. A girl could be given away by her father to a man, exchanged by her husband for other women, or lent as a gift to a guest (Maddock, 1973) (The same was reported among the Bushmen of the Kalahari Desert; Silberbauer, 1982). They were also property in the sense that the more wives a man had, the wealthier he was considered. Women also lacked civic rights. They could not sit on the council of elders that made important decisions—such as moving camp, meeting with neighboring clans, or organizing corroborees—and were not allowed to participate in the prestigious religious ceremonies that sanctified the rule of the elders. Nor were the young men the equals of their elders. They could sit as silent observers at council meetings or during the performance of ritual ceremonies but were not permitted to participate until they were qualified through an elaborate system of initiation ceremonies (Rose, 1968; Abbie, 1969). Full initiation could take more than a decade, with stages involving rigorous physical training, public tests of endurance, mastering magic procedures, and memorizing the group's lore and spiritual traditions. And while progressing through these rites of passage, the young man could not marry and establish a household, and the available young women often became the wives of older men. Thus, this seemingly simple society had a formal class structure: the women being responsible for pedestrian tasks; the young men serving as apprentices; and the initiated men engaging in the noble pursuit of hunting and serving as custodians of the group's spiritual secrets.

AUSTRALIAN ABORIGINAL RELIGION. The aboriginal Australians had no priests or temples, and they did not prey or offer sacrifices to gods or a God. However, they were extremely religious in the sense that other-worldly spirituality permeated many aspects of their daily life. The aborigines referred to their religious life, quite presciently, as “Dreamtime” or “Dreaming” (Spencer and Gillen, 1927; Isaacs, 1980; Berndt and Berndt, 1988). Dreamtime meant parting with the mundane world of daily life and becoming immersed in the sacred world that were made “visible” by masks, body paintings and dances, and “audible” by chants, songs and recited tales. In the animistic mindset of the Aborigines, all things are permeated by spirits, be it a rock, a mountain, a shark, an emu, or a kangaroo, and contemplating them meant engaging in Rock Dreaming, Mountain Dreaming, Shark Dreaming, and so forth. “Dreaming” gave an account of how the universe was created in the distant past, where the celebrants came from, what transpires in the world at the present, and what will come to pass in the future.

The Australian aborigines believed in the great multiplicity of nature spirits or ghosts, and their movements from one entity to another as material things came into existence, changed or disappeared. The individual and the clan descended from a particular spirited object, their totem. The totems, sometimes represented by a painted stone or wood (churinga), was the most precious possession of the individual or clan, which none others but the owner or the initiates were allowed to see or touch. Notably, however, supplication of divine agents was not part of the Aboriginal belief system before they were subjected to the influence of European

missionaries; they sought the control the nature spirits through magic and rituals. All the initiates learned how to perform black magic to make an enemy get sick or die; love magic, to gain favor with a beloved; animal magic to ensure a successful hunt; rain magic to produce rain. Occasionally, the individual turned to the Karadji, a member of the tribe with special skills in magic. The Karadji often used sleight of hand to cure the sick, such as remove an 'evil bone', but that was not perceived as cheating but rather as a symbolic representation of removal of the harmful spirit. While each tribe or totemic group had different myths about their descent, obligations and destiny, and different magic practices, the Dreamtime was the shared religion of everyone. Perhaps that may account for the relative peaceful relations that prevailed among the different tribes throughout Australia.

The Life Style and Culture of the Crow of the Western Plains of North America. A more advanced hunting culture than that of the Australian natives was that of the Crow Indians of North America (Murdock, 1934; Lowie, 1935). The Crows were nomads who practiced no agriculture, had no domesticated animals (except the dog), produced no baskets or pottery. They thrived as hunters by following herds of buffalo, elk, deer, and antelope that roamed in the extensive grasslands. The Crows' principal weapon was the bow and arrow, with a tip made of bone or chipped flint. A large troop of hunters, organized into two or three lines, surrounded a herd and shouting and drumming forced the stampeding animals to fall off a precipice or into a prepared corral, where they were butchered. While the common practice was the communal drive led by a leader, occasionally a single brave, disguised in fur and horns, stalked and killed an animal. When horses (brought into the Americas by the Spaniards) became available, some of the braves rode them into the hunt. The Crows were divided into a dozen clans with an elaborate kinship system, and obeyed strict exogamous marriage rules. Division of labor based on gender was pronounced: the men making weapons, hunting and fighting, and the women gathering fruits, berries roots and firewood, and performing all the menial tasks. Men could not marry until they distinguished themselves as warriors, taking the weapon of an enemy, stealing his horse, capturing his woman, or slaying him and bringing back his skull as a trophy. Successful hunters could have several wives. Hereditary classes were unknown and the titular rank of chief with limited social and political powers was achieved by triumph in warfare.

Crow culture was exuberant, boisterous and self-aggrandizing. Men and women wore colorful, embroidered leather costumes and bedecked themselves with elaborate headgear, earrings, necklaces and other ornaments and jewelry. They also enjoyed playing various games, organized elaborate festivals and were generous to the guests they invited to participate. But they could also be belligerent. The men periodically organized war parties and attacked neighboring tribes, merely to display their valor and prowess. And notably, the Crows sought not only physical but also spiritual exaltation. They believed in a host of spirits immanent in inanimate and animate things – the Sun, Moon, stars and rivers, and trees, birds, and mammals. To communicate with these spirits, the Crows believed in revelations that they received while dreaming or by inducing altered states of consciousness by fasting, bleeding and torturing themselves.

The Life Style and Culture of the Haidas and Kwakiutl of the American Northwest. We now turn to a transitional culture that suggests parallels with the Mesolithic, settled people who have

largely retained the lifestyle and mentality of exuberant and boisterous hunters and gatherers, as exemplified by the Kwakiutl (Boas, 1921; Benedict, 1934) and the Haida (Murdock, 1934) of the American Northwest. While they lived in enduring villages, they did not cultivate the land and had no domestic animals (except the dog) but lived off the riches of the land, hunting bears, trapping fowl, collecting shellfish and taking their canoes to the sea, catching fish, sea lions and porpoises. The tribe owned the land and sea surrounding the villages, but what was acquired was the family's property. They used stone tools to build substantial wooden houses and seaworthy canoes that were embellished by carvings and paintings. They cared about tomorrow: preserving much of the fish they caught by smoking or immersion in blubber or oil. The decorated native clothing consisted of furs and skins, and garments and blankets woven from plant fibers. They made baskets and used wooden pots and utensils for cooking and but did not possess pottery. There was an emerging social stratification, with chiefs and nobles that had limited powers, but they lacked a formal or enduring political organization. A notable characteristic of the Kwakiutl and Haida was that they did not aspire to accumulate property but rather engaged in an extravagant display of their wealth, giving away furs, blankets, baskets, carved dishes, and the like, in ceremonies known as the potlatch. A potlatch was arranged, for instance, when a house was finished, a daughter got married, a grandchild was coming of age, or a neighboring chief was challenged. Members of the village and all prominent people from the villages near or far along the coastline were invited to attend and celebrate. Giving a potlatch was an opportunity for a man not only to feast his guests and part with his precious possessions, but boast about his riches and largesse and glorify himself in speech and song, thereby proving himself superior to all those attending. That, in turn, entitled him to assume a coveted title as a nobleman. Those on the receiving end had to reciprocate at some point in time, and the more one could give away or squander the higher became his social status. When disputes arose, a war was declared. The victors showed no mercy, killed women and children or turned them into slaves, cut off the heads of slain enemies that they put on a pole and displayed as trophies in victory celebrations.

The imaginary world of the Haida and the Kwakiutl was filled with supernatural beings. Spirits dwelled in every object: trees, rocks, reefs, and mountains; swamps, rivers, lakes, and the sea; fish, birds, bears, and whales. Before embarking on a hunting or fishing expedition, the men purified themselves by fasting and abstinence, and a shaman always accompanied them, chanting, reading omens and performing rituals. To appease the spirits, they were given offerings of fresh water or food or a gift, like a feather. And as part of their religious life, the natives erected richly carved totem poles in front of their houses, with naturalistic and grotesque representations of ancestral animals and geometric symbols. The calamities that occurred periodically were believed to be the doings of malevolent spirits and the grotesque figures with big eyes carved on the totem poles or painted on the canoes were to frighten them away. People turned to shamans when they were seriously ill; they believed shamans had the power to cure with sorcery. The shamans competed with one another much like the nobles did, with each one using some secret as his specialty; he was shamed and disqualified if his trick failed. The Haida and Kwakiutl believed that each person has two souls, the dream-soul that leaves the body in sleep, and the shadow-soul that departs upon death and descends to an underworld or rises to the sky. The family of the dead arranged an elaborate funeral, followed by a feast, and the grave was marked by a richly carved mortuary column.

9.5.4. Ethnological Descriptions of Societies Analogous to the Neolithic. An altogether different lifestyle and mindset is represented by some primitive cultures that shifted from hunting to agriculture.

The Life Style and Culture of the Villagers of New Guinea. Much of the Highlands of New Guinea remained unknown to Westerners until the Second World War and the natives were little influenced by colonizers and missionaries. Then, beginning about 1945, anthropologists began to study their life style and social organization (Reay, 1959; Kaberry, 1971; Brown, 1978; Connolly and Anderson, 1987). There is some evidence *Homo sapiens* reached New Guinea about 50-45 k.y.a. (Summerhayes et al., 2010). They lived there for a long time as hunters and gatherers. Then, about 9.0 k.y.a., a group of them began to grow taro (a starchy tuber), sugar cane, yams, and bananas in the Kuk Swamps of the Wahgi Valley (Denham, 2011). They apparently initiated this agricultural practice as an indigenous innovation, independent of outside influences.

NEW GUINEA VILLAGE ECONOMY. The typical Highland settlement consisted of several small houses in a clearing on a gentle slope or a hilltop, occupied by several related families. Some were little hamlets, others were large enough to be a village. The occupants of a village, which had a name, typically spoke the same language and had a shared cultural tradition. Other villages had different cultural traditions and spoken languages. Since most of the villages were autonomous and isolated from each other, the 6 million natives living in New Guinea spoke as many as 820 different languages or dialects (Wurm and Hattori, 1981). The territory surrounding the village was community property but the family that cultivated a plot owned it and its yield as private property. Unattended fallow land reverted to the village community but anyone could claim a plot to build a house and start gardening. The villagers' main crop was taro and yam; banana was their favored fruit. The men typically cleared the land, built the houses, dug the irrigation ditches, prepared the soil, and built the fences. The women did the planting, weeding and harvesting, as well as the cooking. The villagers also produced various tools, including hafted adzes, arrows with bone tips, decorated pottery, masks, and woven carrying bags. Some villages produced these in large quantities and traded them in expeditions, known as *hiri*, along the coast (Dutton, 1982; Fyfe and Bolton, 2011; Goddard, 2011). Seashells were often used as currency in trading.

NEW GUINEA SOCIAL ORGANIZATION. Women and their children lived in small houses; the men spent much of their time in a larger building, the men's clubhouse. The clubhouse served as the village center where men of age debated and dealt with the community's internal and external affairs. Women did not participate in these discussions nor did they have a formal role in the decisions made. An important community affair was the planning and preparation of feasts. Occasions for feasts were the initiation ceremonies for the boys, arranging or celebrating marriages, and establishing peace with a neighboring village. The preparation of a feast took months, sometimes even a year, collecting the largest and best yams, acquiring and fattening dozens of pigs, assembling and displaying the village's wealth. The participants of a feast, often numbering hundreds of people, covered their body with paint; adorned themselves with ornaments of shell and feathers of birds of paradise; performed rituals, chanted and prayed; sang, danced, brandished their weapons, and boasted about their wealth and valor. The

highlight of the feast was roasting and consuming a large number of pigs. The feast established a partnership between the hosts and their guests, who were compelled to reciprocate in kind at some later date.

Manhood—male dominance in domestic affairs and superiority in external relations with the other villages—was the New Guinea social ideal (Godelier, 1985). In the training of the boys, emphasis was on virility, martial skills, endurance, and bravery (Herdt, 1982). Male superiority was further assured by the initiated males' being privileged participants or leader of all the rituals and ceremonies (Harrison, 1985). The villages had no headmen or chiefs and, because there was no shortage of arable land and everybody could support his family, there was no formal class distinction among the villagers. However, since the yield of the cultivated land was considered private property, ambitious individuals could amass wealth in the form of surplus yams and pigs, and they came to be considered "Big Men." The Big Man could acquire several wives, which increased his wealth by being able to produce more yams and fatten more pigs, thus further elevating his social status. The Big Man gave gifts to his poorer neighbors and contributed more than his share to communal feasts. His neighbors thereby became obligated to him and were disposed to do his bidding. However, the Big Man's leadership was limited and temporary. He had no formal way to enforce his will, and his power lasted only as long as he could lavish others with gifts.

NEW GUINEA POLITICAL ORGANIZATION. The village was an autonomous political unit. Relations with neighboring villages were at some places friendly, at others it was in a flux, and at still others it was unceasingly belligerent. In some regions, members of neighboring villages visited each other, exchanged gifts, and participated in each other's pig festivals. In other regions, conflicts arose between villages over ownership of some land, a fruit tree, the theft of a pig, abduction of a woman, or the like, and that led to occasional wars. At still other sites, villages were perennially on a war footing. Wars took the form of an ambush, a surprise attack, or a formally arranged battle where the enemies met at an agreed upon place and time. The warriors arrived with their bodies painted and oiled, fully adorned with feathers and plumes. After an exchange of war cries and insults, a battle ensued that left some injured or killed. Once they got tired of fighting, the two sides parted and a truce was arranged, agreeing upon some compensation or an invitation to a feast. Occasionally a Big Man was able to bind several villages into a confederacy but without a formal government these alliances were short lived.

NEW GUINEA RELIGIOUS RITUALS AND BELIEFS. While the New Guinea villagers did not abandon magic as part of their religious practice, they developed a new creed that involved prayers, offerings and sacrifices to appease the spirits of their ancestors. That led to a shift from an animalistic belief system to an anthropomorphic one. Concern with relations to ancestors also led to guilt feelings and, to cleanse themselves, they developed a ritual of bathing in cold rivers (Gibbs, 1978). Because pigs were their most precious possessions, they were symbolically sacrificed to ancestral spirits who, it was believed, protected their home and the village (Lawrence and Meggitt, 1965; Rappaport, 1984; Lawrence, 1988). The rituals associated with pig cults differed in the various villages and one that has been described was the Cult of Ain (Biersack, 2011a, 2011b). This cult developed concurrently with rumors

of Westerners penetrating the Highlands and the sighting of planes in the sky, which caused bewilderment among the natives. The people of this culture traditionally believed in two realms of the cosmos, the “earth” and the “sky.” The “heavy” terrestrial realm was the site of toil, hardship, disease and death; the “light” celestial world was the site of ease, comfort, health and immortality. The most important element in the sky was the Sun, conceived of as the celestial “eye,” the source of seeing and knowing. They also believed that some of their ancestors ascended to the sky and became immortals, and these had to be propitiated and worshipped to set earthly matters aright. People adopting this cult, erected platforms in the community square and stared at the sun, pointed their spears towards the sky, shook themselves to get into a trance, recited spells to invite the spirits, brought the roasted pigs closer to the Sun so that the ancestors could “eat the smell” of the pork. It is notable that adult males were always in charge of the performance of these rituals. That religious prerogative in combination with their training in masculine virtues and their possession of weapons raised the social status of men relative to women (Godelier, 1985).

The Life Style and Culture of the Hopi Indians of Arizona. The Hopis lived for centuries in the arid plateau of Arizona in several villages, what the Spanish came to call pueblos (Hough, 1915; Murdock, 1934; Clemmer, 1995). The Pueblo Indians, the culture to which the Hopis belonged, began to cultivate maize as long as 4.0 k.y.a. They initially built circular pit structures but later learned to erect solid rectangular buildings above the ground. (Note the similar development much earlier in the Levant; Figs. 9-24, 9-25.) As a defensive measure, the Hopis built their houses on mesas accessible only by steep trails through cliffs and steps carved into the rocks. The conjoined houses, two or more stories high, were built of stone and adobe bricks, cemented and plastered, with each family occupying one or two rooms. The apartments had no outside doors or windows, access to them was mainly by removable ladders. Each apartment had a fireplace, and contained a stone mortar and pestle for grinding maize into flour. Each pueblo also had subterranean chambers that were used as workshops, clubs, and as sites for secret religious ceremonies. The economy of the Hopi villages was based on intensive land cultivation. The staple was maize, which the Hopi either roasted or ground to make puddings, bread, and cake. But they also grew squash, pumpkins, beans, sunflowers and cotton. Due to the aridity of the land, they had to laboriously water their fields, dig ditches and set up windbreaks of branches and stone to protect the crops from desiccation. Because periodic droughts destroyed what they planted, they also sat aside the yield of good years to avoid future famines.

HOPi SOCIAL ORGANIZATION. A pronounced gender-based division of labor existed among the Hopis. The men carried out all the agricultural operations, took care of the animals they kept, and participated in the civic, political and religious functions of the village. They also wove cotton, yucca fibers and hair to produce textiles for robes, dresses, and blankets. The composite tools they used included hammers, axes, awls, and knives made of stone, wood and horn; however, metal tools were unknown. The women collected wild plants, took care of the children, repaired the houses, made kiln-fired ceramic pots, jars and bowls for storing, preparing, cooking and serving food, and produced wicker baskets and trays of high artistic quality. The social organization of the sedentary Hopi farmers was fundamentally different from that common among nomadic hunters. One feature of that difference was the elevated

status of women. Although men tilled the land, the plot they cultivated and its products, and the house they inhabited and its contents were the women's property. The husband was often regarded as an outsider in his wife's home, and land and other property was passed on as inheritance from mothers to daughters not to sons (matrilineal descent). The chiefs of the village were men but the office was inherited matrilineally, passing to a younger brother or a sister's son, never to a son. There were several chiefs. The Village Chief directed communal activities, the Crier Chief made public announcements, the House Chief was in charge of the buildings, and the War Chief acted as a police officer and was in charge of protecting the village from intruders.

HOPÍ MENTALITY. The Hopis called themselves *Hopituh shi-nu-mu*, which has been translated to mean "peaceful little people." In contrast to so many of the ancient Indian societies that cultivated competition, assertiveness and pugnacity in the young, the Hopi cultivated cooperation, submissiveness and endurance. Young girls carried babies on their backs, fetched water, collected firewood, and ground corn. Boys joined their fathers in bathing in the cold water of meza springs, were expected to fast periodically, and their endurance was tested in rolling in the snow and becoming long distance runners. Feuds, theft and adultery were rare among the villages, and murder was unknown. Punishment of transgressors was not corporeal but took the form of public ridicule and social ostracism. Young men and women were expected to marry at an early age and spent great effort in rearing their children. However, the Hopis were always vigilant because their villages were frequently attacked by aggressive nomadic tribes, such as the Navaho, Apache or Ute. And even though their strategy was primarily defensive, continuously patrolling their land, they did occasionally undertake retaliatory expeditions against their neighbors, and behaved much like them, killing and taking scalps.

HOPÍ RELIGIOUS BELIEFS AND RITUALS. The Hopis believed in a multiplicity of divinities, the Sun, Mother Earth, Corn Mother, and so forth, whom they worshipped and prayed to; propitiation by adulation and prayer rather than coercion by magic practices was the way to establish good relations with the divinities. A unique kind of anthropomorphic ritual that the Hopis developed was the Kachina Cult. The different spirits were believed to be residing in carved, painted and dressed dolls that served both as children's playthings and as sacred communal objects. There were Kachinas that were believed to produce rain, grow corn, cure the sick, kill an enemy, and so forth, and these were worshipped to assure a safe life. On certain ceremonial occasions men dressed themselves as Kachina dolls, chanting and dancing, or used decorated prayer-sticks, to which they attached some offering to appease the spirits, such as a some food wrapped in a cornhusk. Throughout the year one religious ceremony followed another celebrating seasonal events, such as the winter solstice, or to assure rain or a good harvest. The Hopis' religious traditions have been such ingrained components of their lifestyle that, notwithstanding powerful modern influences, they remain to this day an integral part of their culture.

The Life Style and Culture of the Tswana Tribal Chiefdoms. The most complex of primitive societies were aggregates of villages headed by a powerful, sometimes despotic chief or king. The Tswanas of sub-Saharan Africa were an example of these (Fortes and Evan-Pritchard,

1940; Schapera, 1956; Lagassick, 1969; Schapera and Komaroff, 1991). The earliest modern inhabitants of this region were the nomadic Bushmen (San) and the Hottentots (Khoe), but beginning as long as 1.5 k.y.a. they were gradually replaced by farming Bantu tribes. By the time of colonization, the Tswana raised sorghum, maize and other crops, and bred goats, sheep and cattle. Two types of Tswana societies existed until the colonial period: autonomous villages of farming families in which there was little difference among them in terms of wealth or status; and centralized tribal societies (nations) with pronounced social and political stratification, headed by a chief and a noble class, ruling a subordinated group of commoners.

TSWANA ECONOMICS AND POLITICAL ORGANIZATION. The Bantu-speaking Tswana of Western Sotho were an example of tribal societies with a chief. These societies ranged in population from a few thousand up to a hundred thousand, sometimes splitting into smaller units by secession, at other times expanding by conquests. Members of the tribe were typically unrelated to the chief by kinship, consisting of a heterogeneous group of commoners and immigrants coerced to live under the chief's rule. The Tswana chief had unquestioned authority and many privileges. In theory, he was the titular owner of all the tribal land; he was the final judge in matters of life and death; he was the commander of the tribal army; and also the high priest communicating with the gods. He could summon his subjects to tribal meetings, mobilize them to engage in public works, or resettle them. He was entitled to receive various goods and services for his personal use or for the use of his court. Because the chief owned the best land and received tributes, he was typically the richest man in the chiefdom. He was also the head magician and priest, responsible for bringing rain and assuring the land's fertility. The chief also had traditional responsibilities. He decreed periodic feasts, where the people were fed and entertained and was also expected to engage in elaborate religious ceremonies in times of economic troubles or natural disasters. However, in many instances, the nobles and council of elders limited his autocratic power. These people were often his kin, respectable men of means, knowledgeable about the tribe's traditions, and familiar with the daily concerns of commoners. When the chief was young and inexperienced, most decisions were made by these councilors who were in charge of several governmental functionaries. Messengers relayed the chief or councilors' commands; overseers collected taxes and supervised public works; captains trained the soldiers; and the soldiers kept order, arresting and punishing wrongdoers, and in time of war fighting in battles. The vast number of commoner's played no role in the election of a chief; the eldest son of the "great wife" usually succeeded his father. However, great decisions were presented to the men at tribal assemblies and their enthusiasm, or lack thereof, allowed the chief and his councilors to test the popularity of their decisions and, if necessary, modify them in the course of proceedings. Women played no role in political affairs and set apart from the men during festivities and religious ceremonies.

TSWANA RELIGIOUS BELIEFS AND RITUALS. Before the Western missionaries' arrival, the Tswana believed in a Supreme Being, the Great Spirit, called Modimo. Modimo was the creator of the world, distant and approachable only by the chief. Being a stratified society, the Tswana also had medicine men and magicians, called Dinkaga, whose responsibility was to use magic to produce rain, protect the village, and ensure communal prosperity. In daily life, people turned to and worshipped an ancestral deity, called Badino. Badino was prayed to and offered sacrifices in order to ensure health and good fortune. If dissatisfied, Badino could

withdraw his support and that could lead to illness and calamities. Because of their ancestor worship, the Tswana funerals were elaborate ceremonies, sometimes lasting as long as a week. A respected father or village elder was given a proper funeral, became a *Badino*, and remained a living presence as long as his descendants felt his “shadow.” The dead not properly buried could turn into ghosts that haunted the village at night. Ancestor worship was reflected by the great respect displayed by children toward their fathers and the elders of the tribe.

9.6. The Cultural and Mental Evolution of *Homo Sapiens*: A Synthesis of the Archeological and Anthropological Evidence

9.6.1. *Cultural Evolution of Homo Sapiens from the Late Paleolithic to the Neolithic.*

Previously we considered the cultural and mental evolution of hominids and hominins during the Early and Middle Paleolithic periods by relying mainly on material remains—skulls, skeletons, manufactured stone tools, and weapons (Section 9.4). Because the hominids and hominins had a different organic constitution and a smaller brain than *Homo sapiens*, we considered it unwarranted to use anthropological data in interpreting their cultural and mental evolution. But because the people of the Late Paleolithic and Neolithic periods were anatomically modern humans, we can use anthropological descriptions and analyses to interpret their cultural and mental evolution.

BRAIN, MIND, AND CULTURE. Since cultural norms and values are the products of abstract ideas (examples: true and false, right and wrong, decent or indecent, proper and improper, pretty and ugly, sacred and profane), we have argued that animals—even chimpanzees, our closest animal relatives—lack a culture because they are incapable of forming abstract ideas. We attributed that cognitive deficiency to an organic handicap in the brain mechanisms of animals. We could not answer the question whether the smaller-brained early australopithecines had a culture because they did not leave behind any enduring material evidence that they did. The first evidence for the emergence of culture comes from the Eolithic period when manufactured tools, Oldowan choppers, were left behind by the larger-brained late australopithecines and *Homo habilis*. After a stasis of about 1 million years, the Early Paleolithic period was followed by the evolution of a still larger-brained *Homo erectus*, who manufactured more advanced Acheulean hand axes. After another cultural stasis of more than a million years, the Middle Paleolithic followed as the largest-brained archaic *Homo sapiens* emerged, producing more advanced Mousterian and Magdalenian specialized tools and artistic products. The pace of cultural evolution accelerated as soon as anatomically modern humans appeared. The Late Paleolithic and the Mesolithic transitions lasted only about 35 k.y. in Eurasia; the Neolithic was next, lasting about 10 k.y. Finally, the formation of more complex urban and imperial civilizations appeared about 5.5 k.y.a.

THE RECIPROCAL RELATIONSHIP BETWEEN CULTURE AND MIND. Mental evolution is a prerequisite of cultural evolution. Culture began when hominins acquired the ability to entertain abstract ideas and invent new products. Cultural evolution is dependent on intelligent individuals who, thinking and reasoning, modify old ideas, and who, tinkering and experimenting, create new artifacts. However, once culture has become established, the course of mental evolution changes profoundly because culture itself exerts a powerful influence.

An established culture shapes the mental development of the young, how adults think and reason, and what they do and refrain from doing. The cultural transmission of ideas, beliefs, norms, and values begins with language, itself a product of culture. Children do not invent most of their concepts and ideas; they assimilate what their culture provides them with by the conventional words assigned to things, events, and their relationships. Children do not invent the utensils and tools they use but learn how to manipulate what they are handed. And children do not generate their own norms and values but accept, willingly or reluctantly, what their elders implant in their minds by rewards and punishments, persuasion and coercion, and a variety of other means. Whatever children are told is “good” or “bad,” “true” or “false,” “safe” or “dangerous” leaves them with the same conviction as what they are told about matters based on factual evidence. A child told not to consume something because it is “hot” will, in the same way, not consume something it is told is “taboo.” The child told not to play with fire because he might “burn down the house” will obey in the same way when he is told not to play with children in the next village because they are “not our kind.” Much of a child’s knowledge is acquired through verbal communication, but children cannot distinguish between the ideas that are based on beliefs (cultural tradition) and those based on facts (empirical evidence). Due to the power of memory, what is implanted into our minds as children endures tenaciously as we become adults. A large corpus of useful knowledge, difficult concepts and some wisdom, as well as prejudices, superstitions and pernicious ideologies are deposited into our brains as our minds are developing. We call these guiding principles “*mnemnon*s” that powerfully influence how we think and reason, interpret what we perceive, and make our judgments as adults. Of course, that does not mean that the implanted ideas, norms and values completely ossify the mind, only that they offer stiff resistance to modification and improvement. Our mind is a dynamic hierarchical system with three battling players. *Mnemnon*s—the carriers of convention and tradition—battle with *affects*—our cravings, sentiments and passions—and with *reason*—our cognitive pursuit of personal achievement.

CULTURAL EVOLUTION AND FORTUITOUS CULTURAL CHANGES. Cultural evolution in the domain of technology and improvements in the exploitation of environmental resources is an established fact. Technological advances can be attributed to mental evolution. Creative individuals invented the techniques to make better tools and weapons, make fire, prepare more palatable nutrients, turn fur into garments, weave baskets, and the like. They passed on these inventions to their fellows and played a role in advancing material culture. Starting with the production of simple choppers and subsisting on scavenging and collecting, our ancestors learned how to become big-game hunters and eventually to become masters of their environment. But that success turned into a disaster because it decimated the megafauna and eliminated their prosperous livelihood by depleting a plentiful source of food and other products derived from large animals. People were challenged to create a new way of life. They settled in fertile lands and, again, individuals with creative abilities began to experiment. They sowed seeds and domesticated plants, produced new tools to till the land and harvest the crops, protected, bred, and fed docile animals, built solid houses using brick and stone, shaped and fired clay to make storage vessels, and so forth. This new way of life required mental adjustments and the development of a new mindset. Humans had to turn from the *intermittent* exertions of hunting to the *unceasing* toil of agriculture. Life became harder and less prosperous for a time but there were gains. Changing from environmental exploitation to a productive economic system, from

consuming only to preserving and storing, resulted in a steady, year-round supply of staples. In some places, that stability led to the production of surpluses, the growth of property, increased fertility and survival. That had social repercussions as the spurt in population growth led to a change in the relationship between those who owned land and those who did not, the rich and poor, the powerful and the powerless. The ensuing social stratification, in turn, led to a new political order, a new moral system, and even new religious beliefs and practices. The ordering of the relationship of individuals and groups with different interests, led to the development of new moral norms and values as well as to different ideas about the supernatural forces that they believed to govern what went on the world that they could not comprehend. Hence there were fundamental changes in social and political organizations, in morality, and in religious beliefs and practices. All this cultural change contributed to mental evolution—not in a steady linear progression like technological advances—but in a far more complex up-and-down pattern.

Stages in the Evolution of Social Organization from the Paleolithic to the Neolithic. Several stages can be distinguished in the evolution of social organization from the Paleolithic to the Neolithic: (i) from small bands of a few families, (ii) to larger tribes with several kinship based clans, to (iii) villages with a heterogeneous population, and eventually to (iv) chiefdoms with several united villages.

BANDS OF FAMILIES AND CLANS. Judging by the scattered remains and the size of rock overhangs and caves occupied by the Mousterians, the social units of the early humans were small bands, perhaps consisting of a few cooperating families. The family in all primitive societies studied by anthropologists was marriage based, with the male, as the husband and father, being responsible for provisioning and protecting his wife (or wives) and children, and the female, as the wife and mother, for maintaining a temporary or permanent home and taking care of the children. All primitive societies also had a kinship system whereby the social and moral obligations to the nuclear family were extended to tradition-based “kin” or clan members.

We have no direct evidence when marriage—a culture universal—came into existence in the course of human evolution but we assume that it had a biological origin—a consequence of the great expansion of the brain and enlargement the skull during pregnancy. Early hominids may have retained the promiscuous sexual life of chimpanzees because neither the male nor the female would have derived any benefit from forming an enduring marriage bond. In both species, with their relatively small brains, birth could occur at a relatively late stage of neuromuscular maturation of the fetus, much as in apes, allowing the infant to cling to the mother and thereby require less maternal care. Moreover, since the australopithecines were not large-game hunters, there was little that a male could offer a female that she could not get for herself. That situation began to change as hominins with larger brains evolved into confrontational scavengers and efficient big game hunters. The mother had to give birth to offspring with enlarged skulls prematurely, making it necessary to hold and carry a helpless and vulnerable infant. The fathers, in turn, would have been motivated to return from the hunt with an ample yield of a food to share with his wife and the children he sired. Furthermore, marriage obligated mothers not only to grant fathers exclusive sexual favors but also to provide

the comforts of a home—by doing all the domestic chores, such as grind cereals, cook, bake, and so on.

The formation of the family as a closely-knit but small social unit, however, created problems because large-game hunting required the cooperation of males and the establishment of comradely relations among them. This, and the need to form larger defensive units than what a single family could provide, may have been a factor in expanding the nuclear family into a kinship based extended family. Supporting that development was the taboo against incestuous sexual relationships and the promotion of marrying outside the family, or exogamy. According to Westermarck (1921), three factors were responsible for the incest taboo in human societies: (i) inbreeding produces physical and mental abnormalities, (ii) natural selection produced an affective aversion against incestuous sexual relations, and (iii) that harm and aversion have led to the prohibition of incestuous marriages. However, the harm of inbreeding applies only to genetic (consanguineous) relatives not to conventionally defined “kin” (such as clan members) to which most societies extend the incest. Hence, it has been justly assumed that exogamy also has an important social function by contributing to the formation of larger social networks (White 1949). Supported by an extended kinship system, for instance, members of one band could approach a neighboring band where, welcomed by kin, they could negotiate to resolve conflicts, arrange marriages and form coalitions.

COOPERATIVE TRIBAL ORGANIZATIONS. As small social units, bands were in many ways handicapped in the struggle for survival. Unrelated bands tend to be distrustful of each other and are liable to have feuds over such matters as territorial boundaries, access to good hunting grounds or fertile land, and grievances about unresolved past conflicts. Bands, as a consequence, can waste much time and effort in fighting one another. Small social units are also less effective in defending themselves against intruders and coping with calamities. And small bands may often have watched herds moving through their territories but lacked the means to encircle and trap them. The advantages of joining forces and forming larger tribal units must have been evident to many bands. Undoubtedly, the successful large-game hunters of the Late Paleolithic were members of organized tribes that arranged big hunting expeditions. Tribal cooperation is clearly attested to at Göbekli Tepe where the hunters gathered and built a massive stone sanctuary.

SETTLED VILLAGE COMMUNITIES. The efficiency of the Late Paleolithic and Mesolithic hunters led to the decimation and eventual extinction of large herds of megafauna in Eurasia. That required a new economic adaptation characterized by settling along fertile riverbanks, flood plains, and other arable sites where people could raise domesticated plants and breed domesticated animals. This happened at several sites at different times, first along the river valleys of the Levant (Middle East), later in India and China, and Europe, and much later in the Americas. Whereas contact and cooperation among clans forming tribes was often intermittent—often called a fission-fusion social organization—contact and cooperation among villagers was continual. Clearing the land for sowing, building substantial houses, erecting fences and protective walls, taking animals to pasture, defending the village from marauders, and so forth, were collective enterprises that required constant cooperation. This led to the development of communal solidarity among people of different family and tribal backgrounds.

Tilling the land and raising animals had some other social consequences. The harvesting of large quantities of staples and permanent settlements encouraged food preservation and storage, and the steady supply of staples led to a population increase, as attested to by the large size of some Neolithic villages. Large yields of cereals at some sites led to the production of surpluses and that allowed increased division of labor. In exchange for food, specialists could dedicate themselves to produce high quality stone tools, leather goods, textiles, and pottery. Traders and peddlers could engage in bartering. This was the beginning of social stratification; more industrious and talented people became wealthy and exerted control over the others.

CHIEFDOMS WITH SOCIAL STRATIFICATION. Once settled villages became common, the next stage in social organization—multi-village chiefdoms—quickly appeared. The Late Paleolithic graves of richly bedecked skeletons are likely to have been local chiefs or nobles. These individuals accumulated riches, and maneuvered politically or fought to become rulers of one village after another, much like what has been recorded among the Tswanas. The establishment of chiefdoms added to the obligations that people already had to their families and local communities. Now, they also had to render services to their rulers. Members of the ruling class—royalty, nobility, generals and priests—subjugated farmers, artisans and laborers. The poorest individuals in the group became their servants and slaves. The ruling class distinguished themselves from commoners by wearing precious clothing and jewelry. But the rulers also provided group-protective services with armies to fight bandits and marauders. Only the rulers could mobilize the group to undertake large construction projects that employed many group members. The rulers periodically returned goods to the group by arranging lavish festivals to feed and entertain the populace. And last but not least, as the high priest, the chief claimed privileged access to the gods who could produce rain, make the land yield a rich harvest, and make their livestock multiply. The populace was made to feel that those ruling them were their guardians, and learned to fear, respect, and admire their power, grandeur, and majesty.

WAS THE CHANGE FROM NOMADISM TO CHIEFDOMS A PROGRESSIVE EVOLUTIONARY PROCESS? Can changing an individual from a free member of a nomadic band into a subservient member of a settled community be considered an evolutionary advance? From a social perspective, the change is an advance towards more efficient use of environmental resources and increased mastery over nature. Most members of the ruling class only sought to keep their wealth and maintain their privileged status, manifesting human egotism and greed. Other rulers became advocates of advancing the technology of their culture by encouraging their subjects to improve the quality and yield of domesticated plants and animals, to develop new building techniques to erect enduring edifices. These enlightened rulers supported artisans who produced high quality leather, textile and ceramic goods. Had these collective products been equally shared, these advances could have benefited all, but the idea of equitable distribution of wealth, as an advanced moral principle had not yet developed.

Stages in the Evolution of Religion from the Paleolithic to the Neolithic. Religion is a culture universal since all primitive societies had a religion; however, the beliefs and rituals of different cultures varied greatly. The origin of religion has been attributed to psychological and sociological factors. Müller (1892), the founder of the science of comparative religion,

held that religion arose from the feeling of awe that people felt by witnessing such wondrous phenomena as sunrise and sunset, the movement and cycles of the moon, and the panorama of the starry heaven. Marett (1914) advocated a similar idea. Spencer (1896) believed that respect for and fear of elders of the community, and of their spirit after they died, engendered religious sentiments. And Freud (1928) argued that religion is an illusion, an obsessional and compulsive neurosis nurtured by the emotions of fear and guilt. In contrast to these psychological theories, Durkheim (1915) postulated the existence of a mysterious force—what he called “collective mind” or “collective conscience”—which takes possession of individuals when they join a religious congregation. Durkheim believed that there are two domains in the universe, the profane (natural) and the sacred (supernatural), and the latter is of great importance as a social force because it unites group members, through their shared beliefs and rituals, into a sanctified community.

STAGES IN THE EVOLUTION OF RELIGION. The idea of stages in the evolution of religion has been controversial. Tylor (1871) defined religion as a belief in supernatural beings and argued that, in that sense, there was no difference between the religion of primitive and modern peoples. Frazer (1922), in contrast, argued that primitive peoples practicing magic and witchcraft had no conception of supernatural beings and therefore lived without a religion. Frazer viewed magic as a practice based on poor reasoning, a form of pseudoscience aimed to exercise control over what transpired in a chaotic, impersonal world. Then, when people realized that magic does not work, they developed the idea that supernatural beings control the universe, and to propitiate them they prayed and offered sacrifices to them. That was the origin of religion.

We develop below the hypothesis that there have been three stages in the evolution of religion from the Paleolithic to the Neolithic. Religion has changed during this period, in parallel with changes in social organization and economics, (i) from the animistic belief and witchcraft of nomadic hunters living in a world of untamed wilderness; (ii) the worship of ancestors by villagers leading a sedentary life in tamed and more hospitable small communities; to (iii) the worship of gods by people living in larger and more heterogeneous societies ruled by a chief and nobles.

Stage 1. The most primitive form of religious belief is that an indwelling primal force, a ghost or spirit, animates everything in the world, irrespective whether living or nonliving. This animistic belief, we postulate, originated with nomadic hunters who began to contemplate what might lurk behind the hazards of nature they were continuously exposed to—the scorching sun, dangerous storms with lightning and thunder, destructive floods and droughts, treacherous snakes and biting insects, alternating times of plenty and shortage, and inexplicable ailments and diseases. Much like children inclined to animistic thinking, early man conceived of all these frightening things to be the doings of malevolent ghosts or spirits. Codrington’s (1891) description of the idea of *mana*, as held by some Melanesian natives, provides the flavor of this belief. *Mana* was conceived of as an impersonal power immanent in many objects that exerted powerful influence on those who came in contact with them and, accordingly, objects that were believed to harbor dangerous *mana* became taboo to touch or consume. And because they were conceived of as impersonal forces without moral qualities, the spirits were not revered or worshipped but feared, and magic tricks, witchcraft, and ceremonies with frenzied

singing and dancing were used to drive them away or subdue them. There is evidence that the hunters of the Late Paleolithic, who left behind evidence of shamanism and magic practices, adhered to this type of a religion (Fig. 9-39).

Stage 2. A totally different type of religion developed in the farming communities of the Neolithic. Living in permanent villages in solid houses that sheltered them from the ravages of nature, they became homebodies concerned about their crops, the fertility and health of the animals they raised, and the safety of their home and village. The young were trained and disciplined to attend to daily chores, and learned to respect the knowledge and wisdom of their parents and elders of the community. When they died, the elders were given elaborate funerals and were buried underneath the floor, within the walls or near the house, believing that their soul, as guardian spirits of the home, remained with them. Instead of fearing impersonal ghosts lurking in the wilderness, people began to pray to and make offerings to their ancestors who were often represented as statues, as was found in Neolithic settlement in Jericho in Palestine, Çatal Höyük in Turkey, and elsewhere. The inhibition of emotional impulses that the performance of the daily chores of sedentary life required was sustained by rigorous adherence to established tradition, and thus reverence and piety gradually replaced magic and witchcraft. Religion was increasingly becoming a moral force and benevolent priests, rather than conjuring shamans, became the spiritual leaders of the commune.

Stage 3. In larger agricultural societies run by chiefs and nobles, religion assumed a new role as a pivotal institution aiding the solidarity of a populace with diverse backgrounds. While the worship of ancestors persisted in the home and the local community, a new type of

LATE PALEOLITHIC SORCERER AND MAGIC



Fig. 9-39. **A.** Engraving of a sorcerer dressed as a deer, from the Les Trois-Frères Cave in France. **B.** Cave painting in Niaux Ariège, France, of a “wounded” bison with arrow tips. (A, after H. Breuil; B, from Clark and Piggott, 1965)

NEOLITHIC RITUAL EDIFICE - STONEHENGE



Fig. 9-40. The sanctuary of Stonehenge, Salisbury Plain, England. (From Liberlexica.blogspot.com)

religion emerged in the expanded society with a pantheon of supernatural beings, conceived of as gods that dwell in the sky or the mountaintops and oversee what the people are doing below. Often there was a principal god, like Modimo, the Great Spirit of the Tswanas, to whom only the chief high priest had access. Many lesser gods were available to farmers, stone masons, weavers, or merchants for support and blessing. Chiefs or high priests commanding the participation of a large population, could erect large sanctuaries, such as the Stonehenge sanctuary built in ancient England (Fig. 9-40).

THE QUESTION OF RELIGIOUS PROGRESS AND OF RELIGION AS A CULTURE UNIVERSAL. The idea of religious progress originated not only as a scientific theory but also as the conviction of many of our contemporaries. The religion of primitive peoples is little more than pagan ignorance, and monotheism relative to polytheism is a sign of spiritual enlightenment. But from a scientific perspective—the critical assessment of available empirical evidence—there is no difference between a belief in ghosts that inhabit inanimate and animate objects and a belief in a single divine being dwelling in the sky. The natural sciences have established a distinct difference between inanimate and animate things and events. Lawful impersonal forces rather than the whim of ghosts or spirits determine what transpires in the physical world, and physical events can only be interfered with or modified by knowledge of those laws not by magic or witchcraft. Likewise, the belief that the earth and the sky are distinct cosmic entities, and that spirits, gods or a god is dwelling above us in the sky, is a naïve idea that makes no sense from an astronomical perspective. And more specifically, modern neuroscience has established that mental phenomena are products of the living brain processing impressions supplied the sense organs, hence the idea that the “soul” of a long dead ancestor is watching what we do and listening to what we say has no rational foundation. Notwithstanding this scientific argument against the veracity of religious beliefs, religion has played an important role in the life of early humans, much as it does to this day.

Not only does religious belief lack a rational foundation but religious activities also consume much energy and effort. Hence the question: why has religion been such an integral

part of all cultures? The reason for it appears to be twofold: religion plays a pivotal role as a coping mechanism in the life of the individual and it serves as a unifying force in maintaining the cohesion and solidarity of societies. There is evidence for a positive correlation between religious participation and mental health (Alcorta and Sosis, 2005). Our mind does not work like a computer programmed to carry out calculations and logical operations mechanically. Our reasoning is under the powerful influence of deep-seated affective forces: fears and desires, anxieties and hopes, frustration in response to failure or injustices, and delight in response to success or good fortune. When we seek equanimity and reassurance, and in particular when we suffer, are depressed, or feel threatened, we revert to the mindset we had as helpless and bewildered children. We pray and beseech the help of the supernatural agents that were implanted into our minds as the masters of our fate and the rulers of the universe. All cultures have institutions that promote and encourage religious participation by giving the supernatural agents substantive form as symbols, amulets, statues or sanctuaries, and as periodic celebrations accompanied by chanting, singing, dancing and other impressive and memorable performances. Religious institutions provide the faithful with readymade answers to all the questions they may have about the meaning of their life and their role in society. Whether the shamans of hunters, the elders of villages or the priests of chiefdoms, these spiritual leaders of society were, from a scientific perspective, ignorant people who had no understanding of real nature and immense complexity of the universe. They deceived their followers in what they taught and practiced. But they also helped their people by providing them with a readymade explanation of the narrow world they lived in and provided them with a moral framework for daily living.

The Evolution of Art from the Paleolithic to the Neolithic. According to the anthropological evidence, adornment of the head and body with paint, tattooing and scarification, wearing of earrings, necklaces and bracelets, dressing in garments of hide, furs and textiles decorated with horns, feathers, and so forth, has been common in all primitive societies. Art is a cultural universal because it gratifies a personal need and has an important social function. However, aesthetic style, the media and techniques used in adorning oneself, and the production of art works vary greatly among different cultures. Following local tradition, males and females wear distinctive garments and different adornments, and in some cultures women's dresses also indicate their marital status. In hierarchically organized societies the style of garments and decorations displayed identifies the individual as a member of a particular occupational group or social class. In addition to body ornamentation, art works such as statues, sculptures and paintings are used to embellish the home and public buildings, and to decorate tools, weapons and household goods, in particular pottery. And in addition to these secular art forms, there were also art products that had ritual uses.

As we described earlier, the production of simple artworks began during the Middle Paleolithic and became widespread by the Late Paleolithic. Late Paleolithic art in Europe consists of over 150 paintings and carvings on the walls of caves and rock shelters, thousands of portable statues of stone, bone, ivory and antler, and a few larger statues made of clay. The principal subjects of the Late Paleolithic cave art were animals of the hunt. Many of them were of the highest artistic quality, evidently produced by trained artists who were fully familiar with the anatomy and behavior of the animals and rendered them by using charcoal for drawing, and

ochre, manganese and other pigments for painting (Chauvet et al., 1996; Clottes, 2003). In the cave paintings, human figures are rare and done with little attention to detail. It is likely that the animals painted in the depths of caves, and visible only with lit torches, must have served some ceremonial or magic function carried out by cult members. In contrast, the small carved statues were often of human figures, particularly of the female body, a few of them carved realistically or symbolically by trained artists, the others, of lesser quality, were possibly mass produced as idols for individuals or a family as visible and tangible displays of their religious faith. Art changed during the Mesolithic as people settled down in fertile areas and began to use stone to build enduring houses. The sanctuary built by hunters on a hill in Göbekli Tepe may have had a ceremonial function analogous to that of the deep caves during the Late Paleolithic. And as farmers settled in villages they began to decorate their houses as exemplified by the wall paintings in of Çatal Höyük. And as they learned to bake clay to produce ceramic ware, increasingly much of the art produced was for domestic use, in particular in the form of pottery of different shapes with intricate decorations, as well as high quality figurines (Fig. 9-41).

SITTING AND STANDING NEOLITHIC CLAY FIGURINES



Fig. 9-41. Two styles of Neolithic clay figurines of a man and a woman, from Romania. (From Neolithic art.flickr)

The Evolution of Morality from the Paleolithic to the Neolithic. An individual's actions that comply with the norms and values of his culture are considered ethical or moral; actions that violate those norms and values are considered unethical or immoral. As a sign of social approbation, moral behavior is called good, right, praiseworthy or virtuous; and as a sign of social condemnation, immoral conduct is called bad, deplorable or evil. All primitive cultures studied by anthropologists had a moral code, hence morality may be considered a cultural universal of *Homo sapiens*. With reference to specific activities, there is a set that all human societies consider to be deplorable—such as incestuous sexual intercourse, murder, rape, lying, theft; and a set of activities that are considered commendable—such as being helpful, generous and trustworthy. These are virtually universal moral norms because they are essential to maintain social harmony within the group. Then there are moral norms and values that differ among cultures, such as who is considered a kin in determining incestuous relationships, whether one may or may not appear naked in public, or what food item one may or may not consume. Significantly, while in all societies the moral norms are compulsory guides to interrelations with members of one's own group, there is variability to what extent, if at all, they apply to outsiders. In some societies killing, raping, deceiving or stealing from outsiders ("strangers," "enemies") are condoned, or may even be considered commendable activities as signs of manliness or virility. And since who is part of the in-group ("us") and the out-group ("them") varies with the size and complexity of society, there are great differences in the morals of people growing up in an isolated clan of hunters, those raised in a larger community of villagers, and those living in a heterogeneous and stratified society of a chiefdom.

Importantly, not all behaviors that can be characterized as commendable or deplorable from a social perspective are moral activities. By definition, morality is based on cultural norms and values, that is, *abstract ideas* that a culture considers commendable (prosocial) or deplorable (antisocial), and which are passed on from one generation to the next by parents and elders training their young. However, animals that do not entertain abstract ideas and intentionally educate their young do display both prosocial (altruistic) and antisocial activities. The most obvious example of altruism is maternal behavior, the arduous labor of mammals in general and primates in particular to feed, groom and protect their young. We attributed that behavior to an organically based emotion, not dissimilar from the love of human mothers for their child. There are also other social affects that foster prosocial behavior as well as those that induce antisocial behavior.

THE FOUNDATIONS OF MORALITY. Inquiry into the mental foundations of morality has a long history. Advocating the role of human emotions, Butler (1726) listed hunger, lust, self-love and envy as passions inducing people to be immoral; and pity, compassion and guilt feelings as sentiments inclining people to be moral. Both Butler and Hume (1777) rejected Hobbes (1651) view that in "a state of nature" human beings are "nasty and brutish," and only calculated self-interest and the coercive power of government can prevent the "war of all against all." Opposing the idea of morality based on emotions, Kant (1785) argued that reason is (or ought to be) the foundation of ethical behavior. Kant pointed out that moral judgments based on emotions tend to be fickle, since they depend on an actor's unpredictable mood, and they tend to be partial by favoring kin, friends and compatriots. Genuine moral behavior is based on the adoption of rational maxims that can be understood and approved of by all.

In the last century, Scheler (1913) proposed a specific affective theory of moral origins by postulating the operation of two powerful human emotions, sympathy and empathy. Scheler distinguished between “fellow-feeling” (*Mitgefühl*), “communal feeling” (*Miteinanderfühlen*), and “empathy” (*Einsfühlung*), and discussed a phenomenon he called “emotional infection” (*Gefühlsansteckung*), the diffusion of a prevailing mood over people when they join a cheerful festivity, a sad funeral, a military parade, or the like. The role of empathy in the development of moral behavior has been the subject of recent psychological studies (Hoffman, 1982, 2000; Zahn-Waxler and Radke-Yarrow, 1982; Eisenberg and Strayer, 1997; Eisenberg et al., 2006; Coplan and Goldie, 2011). A year-old child smiles when a familiar person appears and may offer objects, such as food, to companions or her doll without prompting or praise. Witnessing another child crying, she becomes agitated and may start crying. By about two years of age, children playing together help each other, such as collecting toys or getting a chair, and display solicitousness when they see someone hurting or crying, by patting, hugging or presenting a gift to her. This empathetic behavior is fully developed by three years of age and the child may effectively help the other in distress. More recently neurobiologists have turned to investigate the neural mechanisms involved in the mediation of empathy in adult subjects (Botvinick et al., 2005; Jackson et al., 2005; Lamm et al., 2007, 2011; Bernhardt and Singer, 2012; Zaki and Ochsner, 2012). Evidence is emerging that witnessing the pain of others engages the limbic system, the anterior insula and cingulate cortex, and co-activates other cortical regions.

DEVELOPMENTAL STUDIES OF STAGES IN MORAL DEVELOPMENT. The idea of stages in moral development comes from developmental psychology. Piaget (1932), using a cognitive approach, studied how children judge various acts in terms of their idea of right and wrong. He distinguished two early stages in children’s moral development. During the first stage, called *heteronomous* morality, children’s ethical judgment is based on unquestioned acceptance of the rules set by authority figures. “Good” are acts that parents and caretakers approve of and praise, “bad” are acts that they disapprove of by reprimands or punishment. Children at this stage have no understanding of the reasons why some actions are considered good, and others bad. During the second stage, called *cooperative* morality, children interacting with their peers begin to negotiate what they consider fair or unfair behavior, and develop some of their own ideas of what is right and wrong. Piaget added a third stage, *autonomous* morality, which emerges during adolescence, the judgment of actions in terms of abstract principles of justice and equality, duties and rights shared by all. Kohlberg (1969, 1981) modified Piaget’s theory of moral development by stressing the importance of socialization and education. He called the three levels (each with two sub-stages) the pre-conventional, conventional, and post-conventional. The *pre-conventional* level is the phase before the young child has learned to appreciate the rules of his society that he is expected to obey. The *conventional* level is the phase when the older child learns the rules of his society. The *post-conventional* level is when the adolescent or young adult begins to judge what is right and wrong by using his own critical judgment. According to Kohlberg, passing from one level to the next is sequential but only as a potential. Some individuals never move past the first stage; they remain self-centered all their life and may turn into delinquents or social misfits. Others become arrested at the second stage and slavishly follow the parochial rules of the society in which they were raised. The third stage is achieved by a few through the contemplation of a universal ethical order.

Piaget and Kohlberg's theories of moral development are linked to learning and reasoning without reference to emotions. But as critics have pointed out (Hogan, 1973; Lickona, 1976; Bandura, 1991) the association between cognitive development (intelligence) and moral development (righteousness) is a weak one. No matter how bright a person might be, he will not go out of his way to help those in need or console those suffering if not motivated by prosocial emotions—empathy, compassion, shame, guilt. Modifying Piaget and Kohlberg's cognitive theories, we propose that their three stages may be conceived of as a transition from the affective, the mnemonic, to the rational way of interrelating with others. The pre-conventional stage of moral development can be interpreted as the stage in a child's mental growth before training has modified his raw emotional displays. When the young child is hungry it screams regardless what the rules are about feeding time, and once it has been fed it smiles and coos as an expression of its satisfaction. These affective reactions are innate human dispositions. The conventional stage is the period when habits are formed and behavioral routines and rituals are established by rewards and punishments, praise and blame. Thus, the child's social behavior is gradually modified by the kind of training it receives and how it responds to that training. The post-conventional stage begins with the full development of a person's intellectual abilities and—depending on the education he receives, the environment he lives in, and his personal concern about moral issues—he may reach the level that Piaget called called autonomous and Kohlberg characterized as adherence to a morality of universal justice. Are these developmental (ontogenetic) stages paralleled by evolutionary (phylogenetic) stages in moral development?

THE EVOLUTION OF MORALITY IN PRIMITIVE SOCIETIES. As we noted earlier (Section 8.3.1), chimpanzees display prosocial affects. In addition to the mother's altruistic love for her offspring, and the affection displayed by older siblings and other group members towards the young, adult chimpanzees spend much time to foster social bonding by reciprocal grooming. Occasionally chimpanzees share food with each other and, as an expression of goodwill, one may console another who has been the victim of violence. A chimpanzee may adopt an infant whose mother died, show reluctance to abandon a dead infant, and display signs of depression following the death of a family member. Of course, chimpanzees also display many antisocial activities, such as males fighting each other for access to estrus females, displaying spiteful behavior towards companions, and attack and kill alien chimpanzees entering their home range. It is reasonable to assume that this type of affectively driven prosocial and antisocial interrelations was also characteristic of the early hominids that left behind no evidence that they had a culture. The change to the regulation of social relations by cultural norms and values specifying what is right and wrong may have evolved in hominins in combination with the acquisition of abstract ideas, such as some act being judged just or unjust, virtuous or sinful. Unfortunately, there are few material remains that provide hints about the moral development of early Paleolithic people. Among these is that, as a sign of compassion, they cared for their incapacitated elders and that, as a sign of respect, they buried their dead, including their children (Fig. 9-42) accompanied by reverential funerary rituals.

The moral imperative of respect for the life of kin is a cultural universal. All societies consider the killing of an innocent member of their group as murder, an evil that deserves severe punishment. However, in most primitive societies, the killing of trespassing aliens or the raiding of enemies was condoned or even encouraged. In some cultures it was expected

LATE PALEOLITHIC GRAVE OF CHILDREN

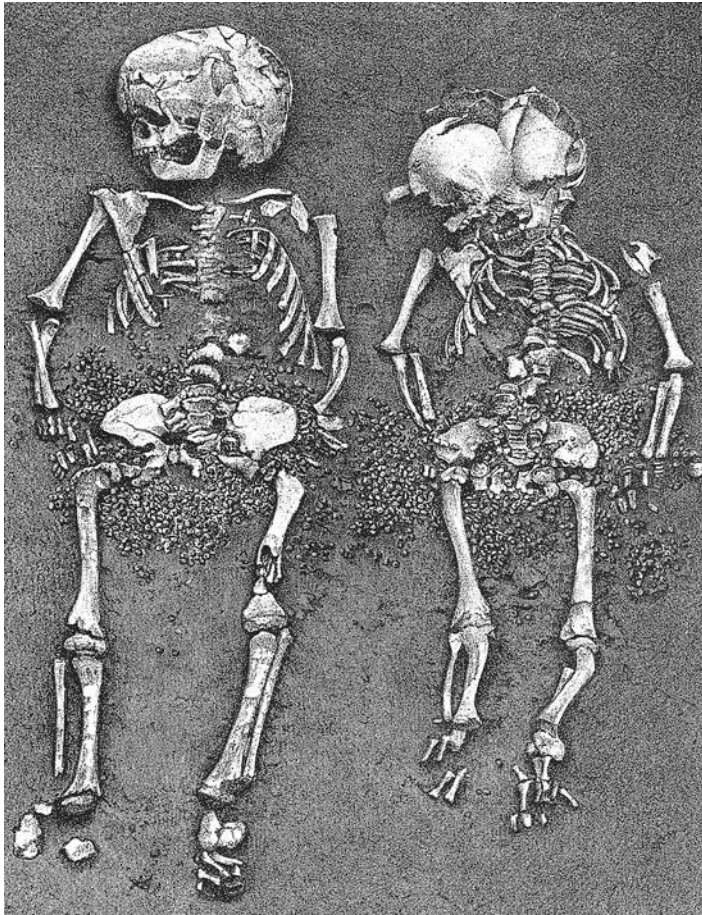


Fig. 9-42. Burial of two young children, with a large number of sea shells, from the Late Paleolithic Grotte des Enfants Cave in Italy. (From The Natural History Museum, London)

that young men should prove their virility by attacking a neighboring camp and return with the skull of a victim. When engaged in warfare, killing innocent women and children was not considered immoral. Since murder is considered an immoral act, the specification of whose killing is considered murder can be used as a gauge of moral evolution against the *summum bonum* that killing any person for any any reason is murder.

Humans, much like many other primates, are aggressive by innate disposition and readily use force against others for gain, and respond with force when insulted or injured. Two situations that have made righteous people of ancient societies kill others were feuds and warfare (Maine, 1861; Malinowski, 1926; Hoebel, 1954; Otterbein, 1994). Feuding is a widespread practice in primitive societies; one family or clan seeking revenge against another due to some dishonor or insult, such as the rape of a wife or a daughter, or the killing of a family member. In small hunting-and-gathering societies, feuds are considered to be affairs between families or clans that are no concern of others, and the taking of a life for a life not only justified but a moral duty of kin. Among the headhunters in Papua and elsewhere, killing another person over a dispute in a fair fight was considered justified, and raiding the camp of another group and returning with a scalp was expected of all males as a sign of their virility and

bravery. In the Yanomamö society of South America (Chagnon 1983) disputes between men were resolved by club and spear fights, and the braves regularly raided neighboring villages and engaged in lethal battles. Of course, such killings lead to a cycle of feuds and warfare and it has been estimated that 35 percent of Yanomamö males died in warfare (Keely, 1997). In terms of stages of moral development, members of such cultures may be said to have remained on the affective level, giving vent to their hostile impulses with no conception of the others' inviolable right to life. A much different moral stance has characterized the Semai. An indigenous people of Malaysia who retreated into the mountains when their land was invaded by technologically more advanced outsiders, the Semai have been described as the least violent people known to anthropology (Dentan, 2008). They teach their children to "give way," tend to resolve conflicts by open discussions rather than violence, and regulate their conduct by public opinion, fearing above all shame and embarrassment. The Semai consider violence as ludicrous and stupid, and reduce confrontations with more aggressive outsiders by fearing and avoiding them. These people may be described as having reached the mnemonic or conventional stage of moral development. However, nonviolence is a difficult survival strategy when there is no place to hide during confrontations with aggressors who have superior weapons. Another mechanism that societies have evolved to reduce feuds and within-group violence is the development of tradition-based rules and regulations—what is considered just and unjust—and have a third-party, such as a council or judge, adjudicate conflicts. However, there is no evidence that any primitive society could avoid the violence perpetrated by outsiders; hence war between clans and tribes remained a way of life and the sanctity of life, the third stage of moral development, little more than an unrealizable ideal of a few sages.

9.6.2. *Mental Evolution of Homo Sapiens from the Late Paleolithic to the Neolithic.* As we have described earlier, brain evolution in our phyletic line began in lower vertebrates that acquired a complex brain mechanism, the paleocephalon, to process unimodal input from the paired eyes, ears, nostrils, and other sense organs. We marshaled evidence that the principal mental mechanism for the assessment of sensory input in fishes, amphibians and reptiles are affects and emotions—like and dislike, fear and anger. A major advance in the brain organization and mental abilities of mammals has been the evolution of a new, superordinate perceptual processing system, the neencephalon, consisting of the thalamocortical visual, tactile and auditory afferent pathways, some cortical association areas, and the premotor and motor cortex and the corticospinal efferent pathway. The neencephalon provides mammals with improved perceptual powers, and a greater facility to store past experience. In addition, a third mental faculty began to emerge in mammals, one that is particularly pronounced in primates—the cognitive ability to perceive how objects and events are interrelated with one another. This cognitive advance was made possible by higher level perceptual processing of visual and haptic information in the posterior cortex, advanced processing of auditory input and improved mnemonic storage mechanisms in the temporal cortex, and reasoning-based executive and instrumental control by the frontal cortex (Fig 9-43A). In addition, components of the limbic system (amygdala, cingulate cortex, insular cortex, orbitofrontal cortex) have also become elaborated in the primate neencephalon, linking our cognitive neural system with the emotional system. It is important to note that the anatomical organization of human neencephalon is not fundamentally different from that of monkeys and apes. We can only attribute our greater inborn mental powers, and our ability speak and lead a cultural life—both

TRIPARTITE ORGANIZATION OF THE APE AND HUMAN EXECUTIVE/INSTRUMENTAL SYSTEM

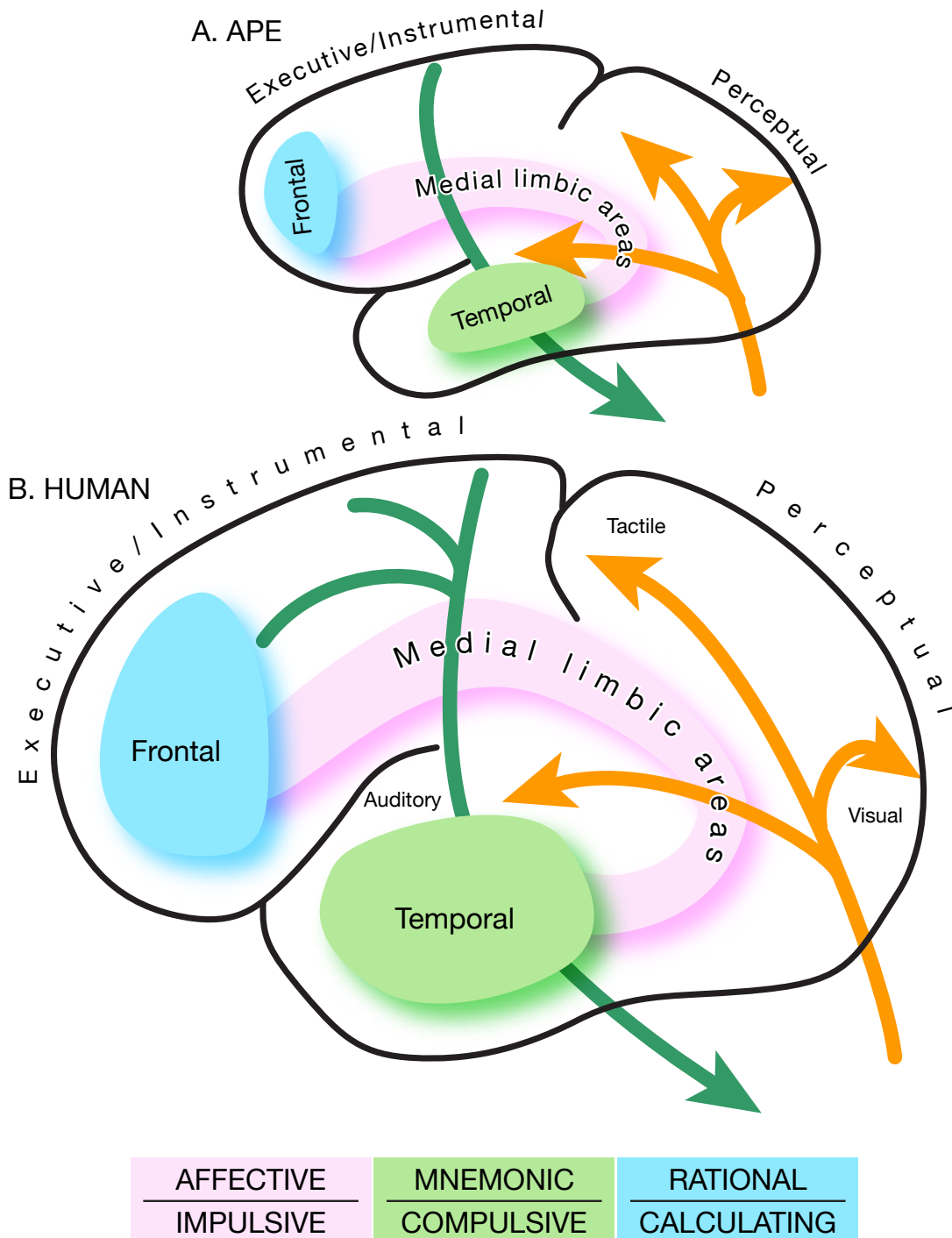


Fig. 9-43. Schematic illustration of the increase in the medial limbic, lateral frontal and inferior temporal association areas from apes (A) to modern humans (B). Arrows in orange, thalamocortical sensory channels; arrow in dark green, corticospinal motor channel.

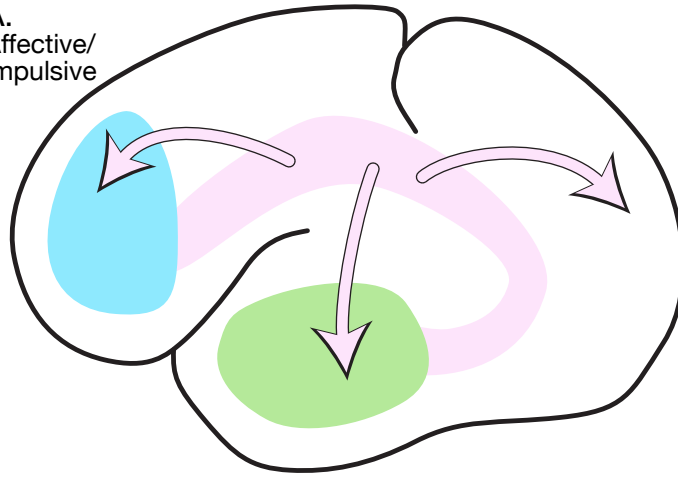
of which have greatly enhanced our mental powers—to the great expansion and elaboration of the temporal-mnemonic and frontal-executive cortical areas (Fig. 9-43B).

Chimpanzees, as we have argued earlier, can engage only in perceptual (“on-line”) reasoning, whereas we can engage in vicarious (“off-line”) thinking and reflection by forming abstract ideas, linking the ideas with words, and use a grammatical language to exchange ideas with one another and pass our knowledge on from one generation to the next. But our ability to think and reflect has not come suddenly as manna from the sky; it has a long evolutionary history, one directly tied to neural and cultural development. The threefold expansion of the pongid brain from the early australopithecines to modern humans took several million years, and so did the advancement of our mental culture from the Early Paleolithic to the Neolithic. Moreover, the evolution of the neencephalon has not meant that the paleocephalon has been discarded, only that a new system was superimposed on it. Paleocephalic emotional mechanisms, in combination with the limbic system, keep exerting a powerful influence on our judgments, mindset and conduct. The ability to reflect and mediate did not mean that humans suddenly became cool rational beings, thinking logically; irrationally persisted, and in some respect has become amplified. For a long period, thinking remained dominated by affects—fear and anger, love and hate, sympathy and antipathy, generosity and greed, and so forth. And as memory capacity expanded and education and training assumed increased importance in mental development, a new irrational force emerged—the persisting memories of dreams, nightmares, illusions and hallucinations, and all the preconceptions, fiction, fantasies, and misinformation that the young are exposed to and which remain indelibly ingrained in their minds. Indeed, our own way of thinking and acting, although we have become far more rational and logical than our ancestors, remain greatly influenced by emotions, and by memory-based preconceptions. We refer to these three modes of mental functioning, alternatively dominated by the limbic, temporal and frontal cortical systems, as affective-impulsive, mnemonic-compulsive, and rational-calculating mindsets (Fig. 9-44). Below we characterize these three modes of thinking and acting and explore their role in early mental evolution.

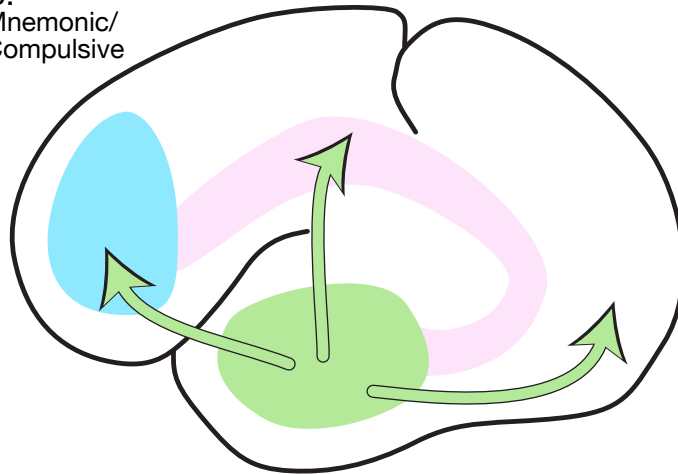
Illogical and Logical Thinking and Acting. Lévy-Bruhl (1923) argued that the the way primitive people think differs fundamentally from the way we think by being “prelogical.” Lévy-Bruhl believed that the mentality of the individual is patterned by the ideas and beliefs (“representations”) of the society in which he is raised, and primitive societies lack our intellectual tradition that valid ideas and beliefs have be based on logical thinking. The prelogical thinking of a native reflects his acceptance of the mystical (“magico-religious”) framework that his culture provides. Natives can reason and use logic in matters that do not involve unknowns but anything that is uncertain, doubtful or threatening triggers a stereotypic supernatural interpretation or explanation, attributing what happens to mysterious forces (magic) or agents (spirits) that are not perceptible or comprehensible but are nonetheless absolutely true. If a tiger kills a person, its role is of little importance, the person died because of someone’s witchcraft or the malevolent design of a demonic force. Malinowski (1944) and Evans-Pritchard (1965) offered a similar sociological interpretation of illogical thinking and acting. The Trobriand Islanders, according to Malinowski, regularly water their plants and weed their gardens, appreciating the importance of these practical necessities, but they also believe that their gardens will not deliver a rich harvest unless they perform a series of

THREE MODES OF MENTAL FUNCTIONING

A.
Affective/
Impulsive



B.
Mnemonic/
Compulsive



C.
Rational/
Calculating

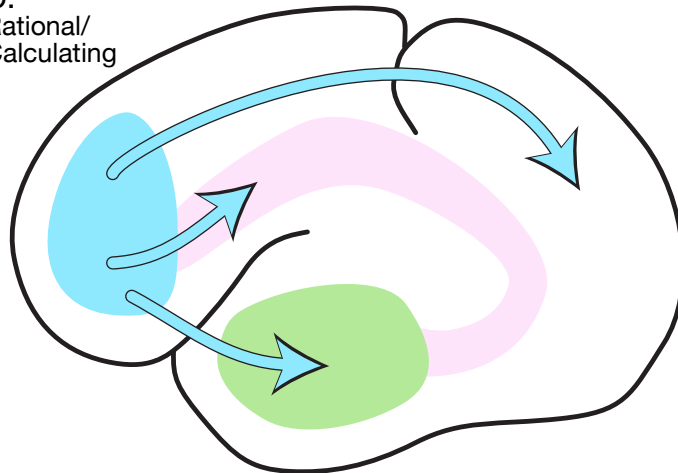


Fig. 9-44. Hypothetical domination of perception, thought, and mindset by the affective/impulsive limbic system (A), the mnemonic/compulsive temporal cortex (B), and the rational/calculating frontal cortex (C).

prescribed rituals. In the enclosed lagoon the islanders fish by relying on their knowledge and experience, but they do not venture into the dangerous open sea without chanting and performing rituals. In his study of the Zande and the Nuer, Evans-Pritchard found the natives to be inquisitive and logical in discussions, and resourceful and skilled in managing their daily affairs, but also compulsive believers in omens and oracles, turning to rituals and magic when dealing with misfortune, illness, death, or any catastrophe.

However, notwithstanding the importance of cultural influences, we cannot understand how an individual thinks and reasons without also considering his innate mental endowments and his reactions to cultural influences. As Marett (1914) pointed out, feelings of wonder and awe make an individual turn to the spiritual world, and it is his physical participation, performing rituals, singing and dancing, that feed his fervor and exhilaration. It is the anxious or frightened individual, the depressed or discouraged, the loving or envious, the resentful or hateful who turns to magic and witchcraft, prays and offers sacrifices to gain the support of supernatural forces or agencies. It is the individual sorcerer, magician or priest with some charisma, or an idol or statue designed and crafted by someone, to whom the anxious or bewildered turns for help. And it is due to individual differences that some people are pious and others are irreverent. It requires mental inertia and gullibility to accept some patently idiotic beliefs and participate in some ludicrous rituals. Indeed, individuals with an open mind come to judge some legends and mythical beliefs as evidently untrue and some magic practices as ineffectual. And it is imaginative minds within a group who create the legends and myths that people come to believe in, and creative minds that develop new beliefs and creeds and start new cults.

The Three Modes of Thinking and Acting. Correlating with our distinction between three fundamental mental dispositions and abilities that control behavior—feelings, memories and reasoning—we offer an evolutionary hypothesis of three modes of thinking: the affective, the mnemonic and the rational (Table 9-2).

AFFECTIVE THINKING. Affective thinking is prompted and sustained by such sensations, feelings and emotions as hunger and appetite, lust and craving, anger and fear, affection and hatred, envy and greed, wish and hope, sympathy and antipathy, and such moods as happiness, depression or despair. Affective thinking leads to narcissistic preoccupation with oneself, bravery and arrogance, haughtiness and exhibitionism, the following of crazes and fads, and the seeking of excitement, adventure, and ecstasy. Enduring effects of affective thinking are greed and hedonism, sentimental attachments and biased judgments, and such passionate pursuits as picking fights, gambling and the excessive use of mood-enhancing substances.

MNEMONIC THINKING. Mnemonic thinking is based on the powerful influence exerted by the ideas that are implanted into our minds as part of our early education and training, and remain the framework for how we assimilate what we perceive or learn later in life. These ingrained mental habits consist of culture-specific values about what is polite or impolite, decent or indecent, true or false, virtuous or sinful. We are not explicitly aware of many of these mnemonic forces because they operate at the subconscious level as unquestioned preconceptions, prejudices, and beliefs. However, we are explicitly aware of other implanted

and assimilated beliefs as articles of our faith, and we consciously use them to organize our thoughts and actions. Mnemonic thinking is collectivistic: “we don’t do that,” “we don’t believe that ...,” “everybody knows that ...” The positive manifestations of the mnemonic mindset are fidelity, loyalty and trustworthiness; its negative manifestations are obeying whatever the authorities decree, irrational conformity with prevailing customs and conventions, prejudicial bigotry, and resistance to behavioral modification.

RATIONAL THINKING. Rational thinking is based on the gathering of as much information as we can to solve a problem. We critically assess that information by applying the principles of logical reasoning to it, either implicitly or explicitly. This mode of thinking, getting to know the facts and assessing them objectively, is an easy mental process when our experience is not in conflict with what we desire or wish, or when it is not in conflict with our preconceptions and prejudices. It is, however, a difficult exercise when our perceptions are in conflict with our wishes and ingrained beliefs. Some of the distinct characteristics of these three mindsets in terms of personality traits, social attitudes, and occupational and avocational preferences are summarized in Table 9-2.

The Role of the Three Modes of Thinking in Mental Evolution. The three modes of thinking referred to—the affective, mnemonic and rational—have parallels with three stages in the

TABLE 9-2
SOME CHARACTERISTICS OF THE
AFFECTIVE, MNEMONIC, AND RATIONAL MINDSETS

	AFFECTIVE IMPULSIVE	MNEMONIC COMPULSIVE	RATIONAL CALCULATING
PERSONALITY TRAITS	ARROGANT	SUBMISSIVE	INDEPENDENT
	BRAVE	CAUTIOUS	SCHEMING
	EXTROVERTED	INTROVERTED	RESERVED
SOCIAL ATTITUDES	REBELLIOUS	CONFORMIST	CRITICAL
	VIOLENT	PEACEFUL	EVASIVE
	SUPERSTITIOUS	FAITHFUL	INVESTIGATIVE
OCCUPATIONAL PREFERENCES	TRADER	LABORER	MANAGER
	TINKERER	ASSEMBLER	ENGINEER
	ARTIST	CLERIC	SCIENTIST

putative mental and social evolution of our Stone Age ancestors from the Early-Paleolithic scavengers, to the Middle- and Late-Paleolithic large-game hunters, and to the farmers of Mesolithic and Neolithic villages. A consideration of man's cultural history indicates that, as a dominant trait, rational thinking developed very slowly until record keeping and writing were invented in the emerging civilizations of Asia and Europe.

THE MINDSET OF EARLY PALEOLITHIC HUNTERS AND GATHERERS. When the early hominids abandoned the relatively safe and peaceful existence of their ancestors in the African forests, by engaging in confrontational scavenging in the open savanna, they had to evolve an intensified affective disposition—courage and ferocity—to battle powerful predators, such as lions, tigers, hyenas and wild dogs. As we have suggested, an organized band of hominids could make these predators abandon their kill by rushing at them while yelling, screaming and drumming, brandishing long sticks and bones, and pelting them with stones. However, this was a very dangerous way of living and only the bravest and most savage of the hominids would have prospered. In the course of time, hominins with larger brains advanced from scavenging to following herds and subduing and killing large game. This must have required the acquisition of a mental disposition that combined daring and savagery with reasoning ability, manufacturing improved projectiles and devising cunning strategies, such as ambushing isolated animals or poisoning them. They must also have developed cultural means to strengthen their bravery. They did that by developing rituals and ceremonies that gave them added support in facing danger. They feasted, sang, and danced to strengthen their bodies and increase their willpower; garbed themselves in the skins of their prey in the belief that they have thereby acquired their power; and engaged supernatural forces through magic and witchcraft to help them in their dangerous pursuits. This affective mode of thinking or mindset was an imperative when the early hominins sought to make a living and survive as hunters in the wilderness.

THE MINDSET OF LATE PALEOLITHIC HUNTERS AND GATHERERS. In time, hominins emerged with larger brains, and then modern humans evolved with increasing cognitive powers. That enabled them to manufacture improved tools and weapons, form larger social units, and devise strategies to encircle herds and drive them into swamps, off cliffs or into prepared traps. This was a far more complex and rewarding existence than led by the hominids but it also meant that more and more had to be learned to become a successful member of the tribe. Learning how to manufacture effective tools and weapons, becoming knowledgeable about the behavior and migratory habits of different animal species, and rehearsing and organizing a hunting expedition required experienced elders to thoroughly train the young in the art of organizing and executing a successful hunting foray. Increasingly the young had to learn more and more to become qualified hunters by supplementing their affective disposition of courage and savagery with the mnemonic faculty of assimilating the tribe's relevant traditional knowledge and skills. The young underwent lengthy training to learn how to manufacture complex tools and weapons, how to accurately hit a target, and how to properly execute an assigned role during different phases of a hunting expedition. The elders, in turn, as custodians of the tribe's hallowed traditions, had to faithfully memorize the secrets, the rituals and magic practices that they believed to be essential for success. Mnemonic thinking and mindset assumed increasing importance.

THE MINDSET OF NEOLITHIC TILLERS OF THE LAND. The prosperous life based on large-game hunting had to be abandoned when the great success of the Late Paleolithic hunters of Eurasia led to an ecological disaster, the extinction of the megafauna and the decimation of some the large herds of grazers and browsers. An old way of life had to be replaced with a new one. Hunters and gatherers turned into breeders of domesticated plants and animals. To accomplish that required changing from the destructive exploitation of environmental resources to the productive technique of cultivating the land and breeding animals. It was through rational thinking that people came to realize that the seeds of some plants could be planted in the spring to produce a crop by loosening the soil, watering the growing plants, and selecting the best seeds for the next round of planting. Likewise, the technique of corralling some animals, feeding and watering them, protecting them from predators, and letting the healthiest and biggest of them live to keep producing more and more offspring, was a rational procedure. The domestication of plants and animals was the beginning of genetic engineering. It was this new way of living that also made possible the specialized production of refined polished and hafted tools, an early form of mechanical engineering. The manufacture of kiln-heated ceramic pottery was an early form of chemical engineering. Building solid houses made of stone and brick was an early form of civil engineering. Finally, exchanging goods by barter was an early form of commerce.

9.6.3. The Emergence of Reflective Consciousness. In our discussion of chimpanzee awareness (Section 8.3.6), we made a distinction between tacit awareness and explicit consciousness. Tacit awareness means that, when awake, the individual is cognizant of what goes in the environment by seeing, hearing, touching, smelling, tasting, etc., in the mental (subjective) sense of these terms. We argued that there is no reason to deny that chimpanzees have this mental endowment because their behavior testifies that they respond appropriately to changes in the environment mediated by these senses, very much like we do. But we also argued that chimpanzees cannot be aware of themselves, again in the subjective sense of the term, because that requires having a self concept—"I see because I have my eyes open"—because they cannot form abstract concepts. Without abstract ideas and words denoting them, chimpanzees cannot engage in vicarious thinking, let alone reflection and introspection. We do not know when the ability to form abstract ideas and assign words to them emerged in the course of human evolution. Therefore, we cannot give a date when man began to reflect upon the forces that animate things and how events are causally related with each other. Evidence for reflection comes from material remains, such as the use of magic and rituals, to manipulate the forces that were thought to animate things. Late Paleolithic man made the step towards inquiring into why things happen the way they do, but did so merely to gain practical ends. When did man begin to reflect about the meaning of life and death; the forces that regulate the behavior of other people; and in particular the forces that govern one's own behavior? Burying the dead with accompanied rituals is the first evidence of meditation about life and death, a practice fully developed by the Late Paleolithic. The anthropological evidence is that all primitive cultures had moral norms designed to foster prosocial behavior and discourage antisocial behavior. Since primitive *Homo sapiens* populations used various educational methods to encourage the young to display virtuous conduct, they must have had an understanding of the importance of teaching and training to control the emotions. Finally, the deliberate practice of self-improvement by individuals—exercising, fasting, improving one's

technical or martial skills—indicates a recognition of some of the forces that govern one’s own behavior. Reflective Stone Age humans were evidently becoming explicitly conscious of themselves and the world they lived in.

9.6.4. Our Paleolithic and Neolithic Legacies. We summarize below several of our anatomical, neural, mental, and cultural characteristics that we inherited from our hominid, hominin and early human ancestors. Of these, the organic traits, such as bipedality and a large brain, are their enduring legacies; others, such as improvements in the manufacture of stone tools or living in tribal societies, constitute ladder steps in our evolutionary history (Fig. 9-45).

(i) *Bipedal locomotion.* We differ anatomically from apes by a skeletal system adapted for standing and walking upright, and for using our fully liberated hands to manipulate and carry objects. That trait may have evolved among the hominoids, *Sahelanthropus*, *Ardipithecus* or *Orrorin*; it became a well established anatomical feature of the early australopithecines.

(ii) *Increase in the size and complexity of the neocortex.* Brain expansion, as judged by cranial capacity, was minimal in the early australopithecines but substantial in *Homo habilis*. The process continued in *Homo erectus*, *Homo heidelbergensis* and archaic *Homo sapiens*. The

CULTURAL ADVANCES FROM THE PALEOLITHIC TO THE NEOLITHIC

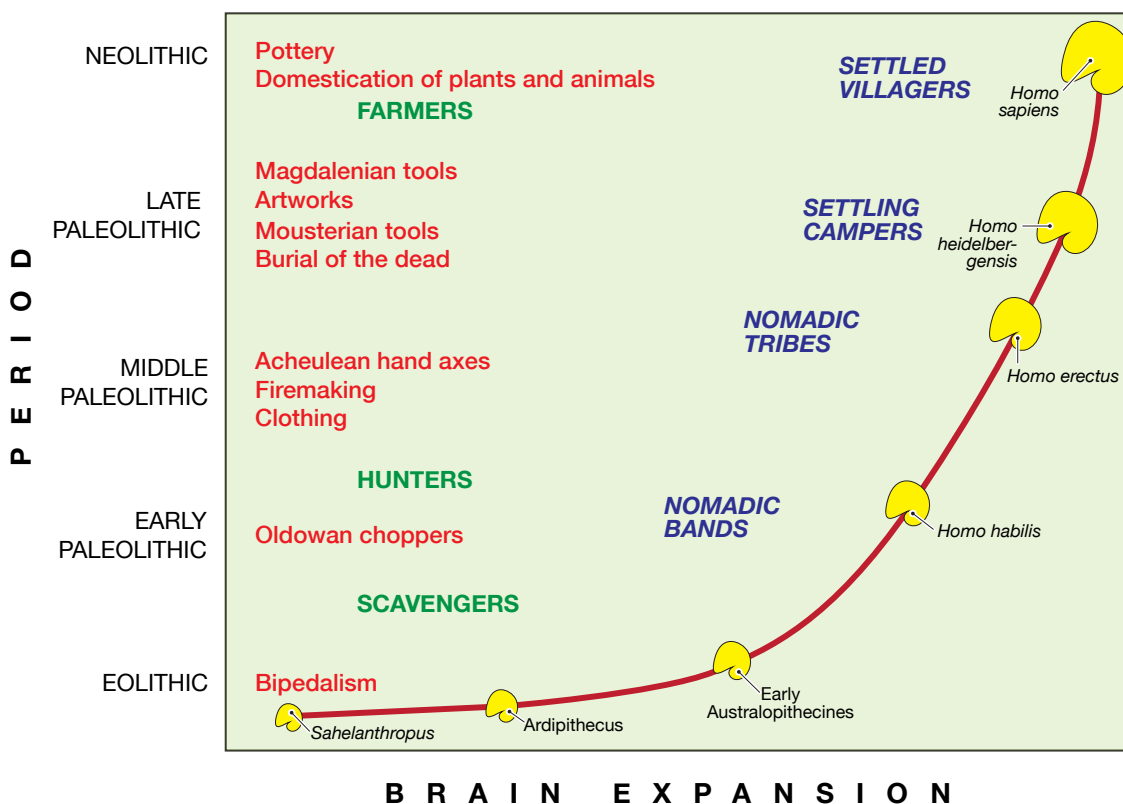


Fig. 9-45. Material (*red*), economic (*green*) and social (*blue*) advances of our ancestors in relation to brain growth.

neocortex of Late Paleolithic gracile *Homo sapiens* may have been structurally indistinguishable from ours.

(iii) *Reduction of the muzzle.* The flattening of the face, which reflects the transformation of the jaws and mouth from a power organ to a precision organ for speech production, began with *Homo habilis* and assumed its modern form in *Homo sapiens*.

(iii) *Early delivery of the young.* The premature delivery of the young is a special human adaptation to the limited circumference of the pelvic opening surrounding the entry to the birth canal. That adaptation had many cultural consequences and may have evolved in *Homo sapiens*.

(iv) *Improvements in tool production techniques.* The late australopithecines invented the production of simple, multipurpose stone tools. Subsequently, improvements in stone tool production techniques were made by *Homo erectus* and *Homo heidelbergensis*, culminating in the production of finely wrought specialized tools by *Homo neanderthalis* and *Homo sapiens*. As the Neolithic was ending, stone tools were gradually replaced by metal tools.

(v) *The development of language.* The production of improved tools requires not only planning by a master artisan but also the training of apprentices and the cooperation of assistants. This presumes a basic form of linguistic communication. The organization of a large scale hunting expedition, such as discussing the strategy to be pursued and assigning responsibilities to different members of the hunting party, requires more sophisticated linguistic communication. We assume that *Homo erectus* used a simple language, and the large game hunters of the Late Paleolithic, gracile *Homo sapiens*—much like all the primitive peoples studied by anthropologists—had a fully evolved grammatical language.

(vi) *The invention of fire and making garments.* The australopithecines were not able to leave tropical and subtropical Africa. That was accomplished by *Homo erectus* who learned to make fire and, presumably, acquired the skill to use skins and furs to keep warm in the temperate zones they invaded.

(vii) *The establishment of the institution of marriage.* Chimpanzees are promiscuous and the archeological evidence does not provide direct clues when the institution of marriage evolved in the course of human evolution. We surmise that the advent of large game hunting provided the incentive for a woman to commit herself to a single man who would provision her and the children he sired with ample supply of precious meat.

(viii) *The invention of kinship systems.* Small bands cannot engage in large game hunting; that requires an organized party of cooperating fighters. The institution of exogamy, and keeping track of kinship relations with defined mutual rights and duties, aided the unification of several bands into cooperating tribal societies.

(xi) *The domestication of plants and animals.* The efficacy of the Late Paleolithic hunters led to the extinction of the megafauna. Beginning during the Mesolithic, people began to settle

in fertile areas where plants were growing in abundance, the rivers contained large supplies of fish, and animals were still roaming about. During the next stage of human evolution, the Neolithic, several suitable plants and animals were domesticated and man the hunter turned into man the farmer. We can thank our Neolithic ancestors for the majority of the plants and animals we use as food staples to this day. It was also during this period that the basic techniques to build enduring dwellings, make pottery, and produce baskets and textiles were developed.

(x) *The development of art.* There is no evidence that the Early Paleolithic hominids produced works of art. There is some evidence that they used ochre for body paint by the Middle Paleolithic and, possibly, for the production of simple carved figurines. During the Late Paleolithic, *Homo sapiens* produced a variety of aesthetically advanced artworks using different media and serving secular and religious functions.

(xi) *The development of religion.* There is no evidence that the Early Paleolithic hominids performed religious rituals. The earliest evidence for the burial of the dead comes from graves of Neanderthals. By the Late Paleolithic, the burial of the dead with grave offerings became common, and during the Neolithic the dead were buried inside or around the home, attesting to ancestor worship and a belief in the soul's survival after death.

(xii) *Affective hyperaggressivity.* Successive large game hunting requires fierceness. That trait, which may have led to a genetic selection of hyperaggressive males, is an enduring legacy of ours, as indicated by the willing participation of so many people in wars and violent crime, and the pleasure that so many people take in engaging in or watching different forms of violent sports and entertainment.

(xiii) *Affective hypersexuality.* Promiscuous hypersexuality is a prominent trait of many primates but the cultural institution of marriage requires fidelity between spouses. We assume that hypersexuality persisted among early humans as a genetic trait of domineering males, and it still interferes with our cultural ideal of monogamous spousal relations.

(xiv) *Mnemonic gullibility.* A society's cohesiveness and solidarity requires that its members obey its shared cultural values and norms. That adherence is fostered by mnemonic mechanisms that establish ingrained and indelible mental habits. But that disposition has made primitive man gullible, accepting legends, rumors, prejudices and falsehoods as if they were empirically established facts. This trait persists in many societies to this day.

(xv) *Rational callousness.* The positive function of reason is to critique wishful thinking and faith-based reasoning by subjecting them to logical analysis. But as an objective calculating mechanism, reason can lead to the callous disregard of what people need and desire. The rise of callous chiefdoms in the Neolithic world signaled what scheming managers can do in enslaving and exploiting people. This trait became predominant as tyrants and autocrats established and ruled kingdoms and empires.