

## **CHAPTER 7**

# **The Paleolithic origins of art, its dynamic and topological aspects, and the transition to writing**

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### **Introduction**

The beginning of graphical arts can be dated by the first appearance of concentrated color pigments in the context of hominid dwellings. Barham (2002) reports that in south central Africa pieces of iron hematite (often called ochre) and specularite were recovered from an archeological site near Twin Rivers, in Zambia. They had been brought to the site, processed and rubbed against surfaces. One can infer that these materials were used to color objects, bodies or surfaces. The use of such pigments establishes a continuity, which reaches from the archeological sites mentioned (i.e. from 270,000 BP) to contemporary hunter-gathers in the Kalahari. The first engravings on stone were also found in Africa and can be dated to 70,000 BP. One can conclude that archaic *Homo sapiens* used colors to paint (e.g. their bodies, objects, and/or large surfaces). A larger corpus of paintings, engravings and sculptures appeared only in the Upper Paleolithic and the following discussion will be mainly concerned with these products. Nevertheless it must be kept in mind that art and modern man have their origins in Africa (and not in Western Europe).

The period of the later Paleolithicum (or the Upper Pleistocene, i.e. 130,000 to 10,000 BP) is characterized in Europe by strong climatic changes called ice ages and interglacial stages.<sup>1</sup> The average temperature in July varied between 20°C in the hottest periods and 0°C in southern Europe. With the climate the plants and animals changed and with them early man's conditions for survival. This period is associated in Europe with the Neanderthal and the Cro-Magnon man. Modern man, called Cro-Magnon man, probably left Africa to expand in Europe and Asia about 100,000 years ago. In Skhul and Quafzeh (Israel) fossils of early modern

man were found which are 90,000 years old. The main stream of these populations did not penetrate Western Europe until 40,000 BP; they were probably in contact with Neanderthal man in Europe only in the Near East. Fossils of early modern man are found across Western Europe dating from 40,000 BP<sup>2</sup>. The youngest fossils were found in Vindija (Croatia) (20,000 years old) and in Zafarraya (Spain) (32,000 to 20,000 years old), from a period in which Neanderthals still survived. The general scenario between 40,000 and 20,000 BP (the time of the cave paintings) in Western Europe can be described as a continuous expansion of Cro-Magnon man (either coming directly from the Near-East or North Africa or returning from South Asia). The Neanderthal population either disappeared for some reason or was mixed with the far more numerous Cro-Magnon populations, so that Neanderthal genes disappeared into the European Cro-Magnon genome.<sup>3</sup>

The basic physiological and neural preconditions for articulated language were already given at the stage of *Homo ergaster/erectus*.<sup>4</sup> Probably the Neanderthal men and early modern men (around 100,000 years ago) were able to use an articulated language, although its grammar may have been very different and its functions less diverse than human language today. The period I will try to interpret from a semiotic perspective concerns the first engravings on stones, bones and ivory dating from about 30,000 years ago, the first sculptures from 27-20,000 years ago and the paintings in caves from 30-15,000 years ago.<sup>5</sup>

I will consider four stages of figural symbolization (“art”), which preceded the development of writing. Roughly speaking, this evolution/development covers the period between 40,000 to 12,000 BP:

1. The engravings on tools
2. The first “sculptures”
3. The painting of caves

The periods of these symbolic activities may be related to different “industries” of stone shaping described in Table 1.<sup>6</sup>

40,000 BP	30,000 BP	20,000 BP	10,000 BP
isotope stage 3 62-32,000 BP	isotope stage 2: full glacial (isotope 180) 32-13,000 BP (cf Gamble, 1986: 82ff)		stage 1: late glacial 13-10,000 BP

**Table 1.** The periods of Neolithic stone-industries and correlated time periods

## 1 The evolution of art from the Paleolithic to the Mesolithic

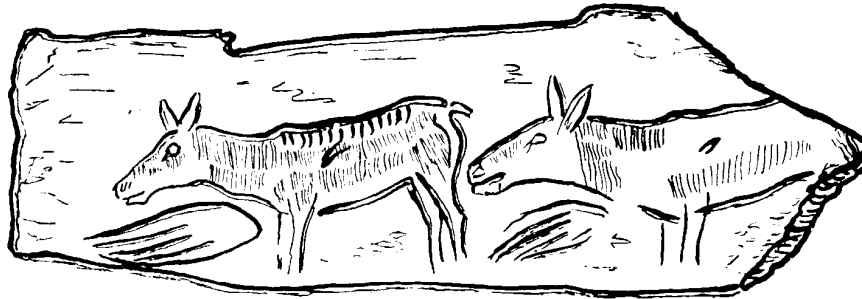
The development of symbolic forms in the period from 40,000 to the first oriental civilization in Mesopotamia and Egypt may be called “evolution,” but this term does not have the same meaning as in the case of the “evolution” of animals, hominids and modern man. The time-scale of thousands and hundreds of years is too small for a purely biological interpretation of semiotic evolution. Biological potential had only changed minimally in this period and “evolution” properly concerns the exploitation of biological potential, adaptation to new ecological niches, development of special skills and mainly cultural evolution under the condition of population growth and intensified contact between human groups and societies. The basic question is, why did new symbolic activities like the engraving of tools and the painting of caves emerge in a certain period, in some cases in areas, which were not in contact with each other? Was there a transition (catastrophe) line, which triggered the appearance of a new kind of semiotic activity? This question is important because if we are able to describe and explain the emergence of new symbolic activities, we may reach new insights into the underlying cognitive capacity of man, its potential for communication and the factors which played a role in uncovering the biologically latent possibilities of sign-usage.<sup>7</sup>

## 1.1 The engravings on tools

Tools of stone, bone, ivory, wood, and clay have been made since the time of the *Homo erectus*. They belong to the category of transportable pieces of art (*art mobilier*) and thus rather to profane life than to ritual or sacred contexts. The artistic forms found are mainly either decorative, i.e. geometrical, or representational, i.e. the shape of an existing object may be inferred. In many cases they are both. Thus at this stage we may clearly distinguish between a kind of self-referential form-giving, i.e. in the ornament, and iconic art, which uses realistic contours and colors perceived in external objects, animals, etc. This art is not yet self-referential in the sense that the human body, or groups of people are represented. A trend towards abstraction on the one side and towards mimesis on the other is present from the beginning and points to two basic dimensions of semiotic activity.<sup>8</sup>

The engraved bone in the possession of a person (cf. Figure 1) and the engraving may be used as a prototype (or a model of imitation) which orients further perception of similar objects. It is also an object of value (it can be given, stolen, inherited or buried with the owner). Becoming an object of value marks the point of transition to ritual and magical objects. The stability of the sign-form attracts other meanings and helps to organize a whole field of mythical or religious knowledge, which existed as belief or behavioral schema before the time-permanent sign was endowed with its meaning. Hence, the system of beliefs and practices becomes psychologically sizable with the help of permanent signs.<sup>9</sup>

The technique of engravings on objects may be extrapolated to architecture as Paleolithic huts were built with big bones, wood and coat. If the group lived in caves or “abris” or used them as ritual places, the walls could bear engravings or be sculptured. The first technique was used until Neolithic times and is still practiced by tribes in Australia.<sup>10</sup>



**Figure 1.** Bones of mammoth figural engravings on a bone from the cave Chaffaud (France; cf Rhotert 1956: 19)

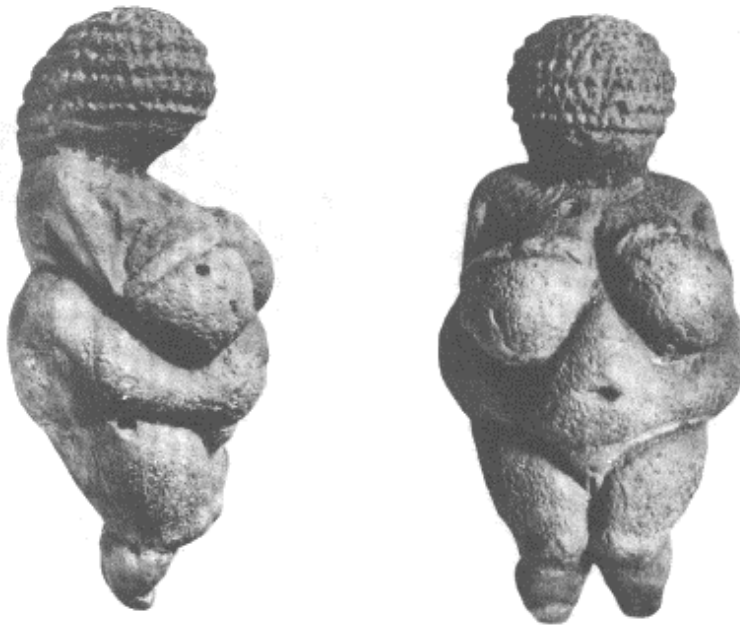
## 1.2 Paleolithic sculptures

These sculptures may be small as the famous “Venus-statuettes” found in France, Italy, Austria, Siberia, and many other places. They typically overemphasize sexual attributes. In other cases the sculptures are very realistic, as are the bison made out of clay in the cave Tuc d’Audoubet (cf Leaky 1981: 174). The sculpture may even be a decoration on a weapon or a ritual instrument. Figure 2 shows two perspectives on the “Venus of Willendorf” (Austria).

Female attributes are overemphasized (cf the breast, the abdomen and the backside). The hair is fashioned in a very specific way. Although these figures are not universal, they define a certain style of art. Simultaneously they create models for human bodies, ideals to be striven for. If the model was a pregnant woman in Paleolithic time (in certain cultures), this corresponds functionally (although in the inverse sense) to modern ideals aimed at by women in beauty treatment (or after a surgical change of shape).<sup>11</sup>

The three-dimensional sculptures of human bodies and animals could have been linked to norms valid for sexual selection in certain societies and later for animal selection in breeding. In this case the sculpture (or the painting) does not primarily represent existing entities, it rather symbolizes a rule for how to shape and transform existing entities. The sign becomes a medium of invention and innovation; it transports a “logica inventionis” in the sense of Leibniz, a design for how to shape things. The transition between a semiotic system, which represents the world and thus helps to achieve a level of collective perception and a system, in which the future

of the world is designed *in abstracto*, is decisive. It allows for a new pace of cultural evolution guided by innovative and intentional imagination.<sup>12</sup>



**Figure 2.** The “Venus of Willendorf” (cf Mirimanov 1973: 47)

### 1.3 Paleolithic cave paintings

Cave paintings occur mainly in an area north and west of the Pyrenees (mainly in Périgord, Toulouse (France) and Cantabrica (Spain). Probably the area was a very early economic “Kulturbund” (network of civilizations) in Europe. The herds of reindeer (as in northern Finland today) defined the relevant ecological dynamics. They probably came to the plains in winter and returned to higher grounds in the Pyrenees, the Cantabrica Mountains or the Central Massif in France in summer. The populations of Cro-Magnon men followed the herds and thus came into contact with other populations in southern France and northern Spain. This contact and common basis of survival would explain a common (or similar) system of beliefs, myths, and rituals, the expression of which are the cave paintings in

this area. Consequently, these paintings are the result of a rather specific, although geographically large, “civilization” and it is even possible that some painters/medicine-men were able to circulate in this culturally homogeneous area.<sup>13</sup>

Reindeer typically do not figure in the paintings. This could mirror a fundamental difference between Paleo- vs. Mesolithic societies. The animals in the cave-paintings would, on this account, stand for the world outside the context of human society and the world controlled by humans, i.e. the separation of an autonomous human ecology from a wild, dangerous, uncontrolled outside world. Shamanism, magic and finally religion are symbolic tools to “control” the domain outside real, practical life, to control chaos in a modern sense. Figure 3 shows the distribution of painted caves in France and Spain. Animals like the bison, the wild bear and the wild horse were in a certain sense “candidates” for domestication but were still wild. The symbolic control of these animals thus precedes their control through domestication (and prepared it unconsciously). In Figure 4 a horse and a bison are shown.

The fascination of the Franco-Cantabric cave-paintings comes from their vividness and the amount of movement “frozen” in the work of the painter. This points to a basic dynamism of figural art and could be linked to dance and to rituals in the context of which these paintings had their place, e.g. in initiation rituals.

The high points of cave painting occurred from the late aurignacian to the middle-magdalenian (cf Table 1) and declined rather quickly towards the end of this period. In the period of decline the paintings became smaller, were reduced to contours, sketches and finally to schematic signs (cf *ibidem*: 22). Although this decline probably had economic or religious causes, it exemplifies a basic gradient of semiotic systems called “grammaticalization” in linguistics. A sign has a rich referential meaning (a realistic imaginistic content) at the beginning. Then it loses this content and is reduced to a functional schema in the context of a larger complex of meanings (e.g. in the context of a ritual the painting may fill a slot in a complex of ritual activities, in the context of a sentence a prior lexeme may become a grammatical item linking other lexemes or integrating them into the sentential frame).

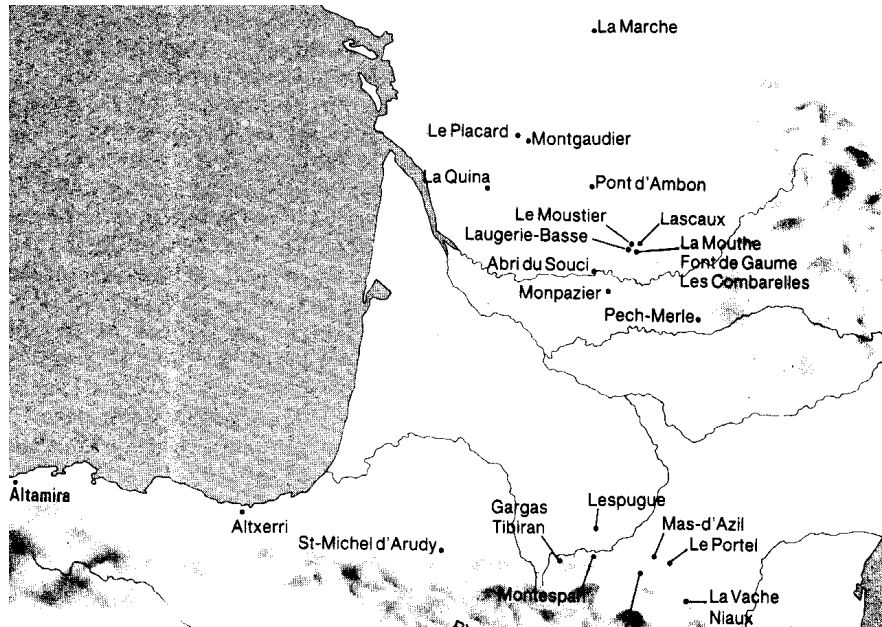


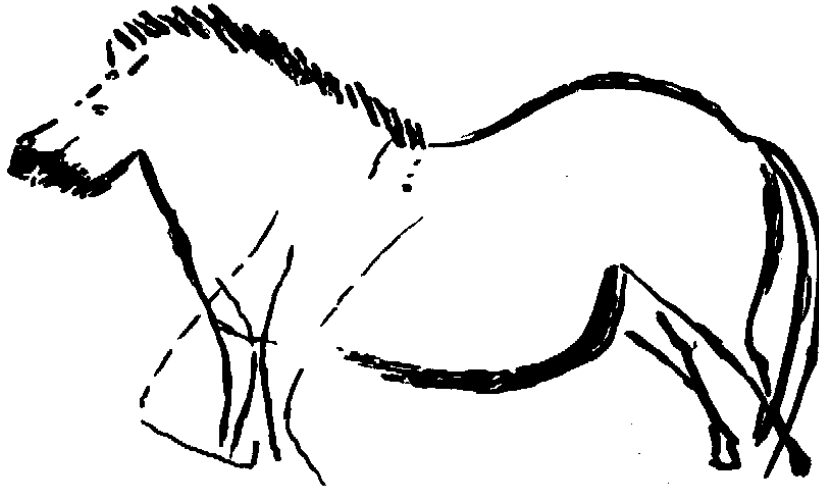
Figure 3. Major caves where Paleolithic art was discovered (cf Leakey 1981: 168)

Figure 5 gives a series from a detailed (3) to a sketched (2) and a schematic (1) picture of a deer.<sup>14</sup> Stage (1) may be further reduced to a symbol without iconic support. For the users of the cave the meaning was known (and even the hidden iconic cues could be read), but for those who did not participate in the ritual, they looked like ciphers of some unknown alphabet. As we know that alphabets are a much more recent phenomenon, we have to interpret these signs as mnemonic structures. There was a corpus of common knowledge in these societies and the painter was aware of this knowledge.

The awareness was probably established by formalized teaching in initiation periods and by rituals, or restricted to functional roles in the tribe (e.g. the role of the shaman). The “reading” of the paintings presupposed this knowledge, which had acquired social value. Even before a system of writing was introduced, a corpus of knowledge, of which persons in specific social positions were aware, could exist as a semiotic system. As this knowledge was not acquired in “natural” practices by emulation or imitation (as tool making) it had to be “objectivized” into signs, which could be rituals, paintings, sculptures, music, dance, prayers, etc. As a result of this objectivization cultural knowledge became a socially codified system of



signs which prefigured the later graphical mode of codifying it, i.e. writing.



**Figure 4.** Paintings of a horse (Peña de Candamo); cf Rhotert 1956: 20f)

After this step cultural evolution had reached a level of organization which made writing possible and profitable. It had only to be invented and elaborated by use.

In Figure 6 a painting which mixes the figural representation of an animal and schematic drawing is shown. In principle, one part of it could be the topic (e.g. the animal), the other the comment, or in grammatical terms, the subject and the predicate (to chase, to kill, to bring home, to eat, etc.). The figural language would be similar in its basic organization to the transition between one-word-utterances (either subject or predicate) to two-word-utterances (one part is more referential, the other more grammatical as in pivot-words).



Figure 5. Three representations of a deer (cf Rhotert 1956: 23)

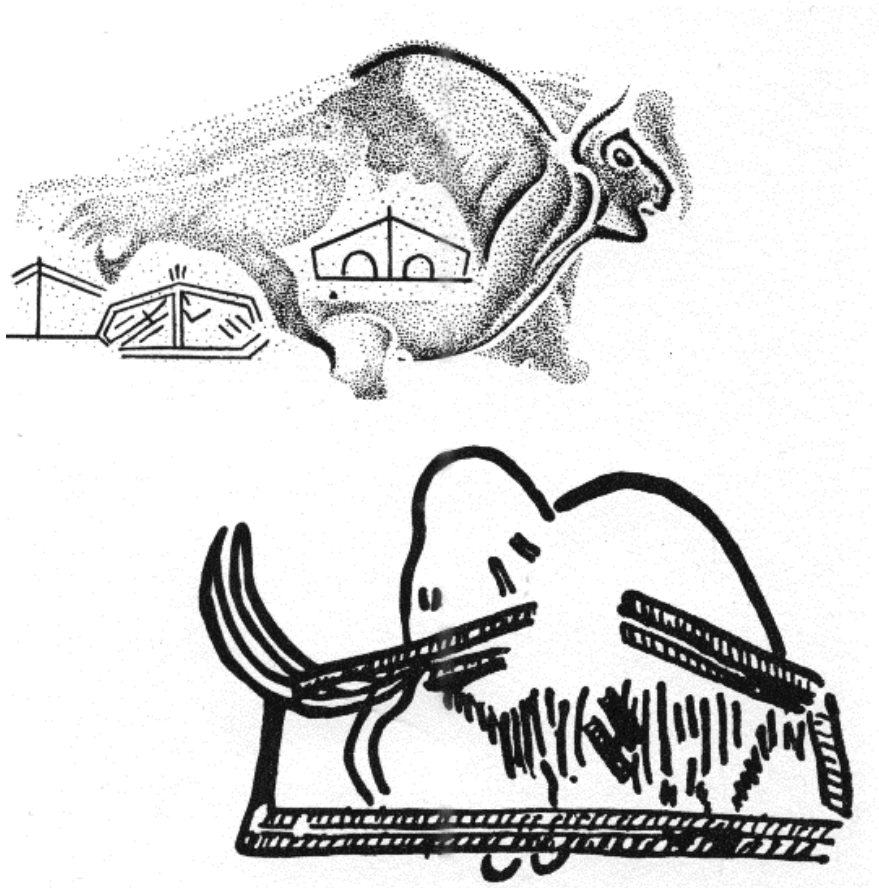
#### 1.4 The representation of humans in a social context

In the cave painting of the Franco-Cantabrian tradition human beings are rarely represented.<sup>15</sup> In the period between 12,000 and 7000 years BP, i.e. just before or after the rise of agriculture, a wealth of engravings is found in which humans occupy the central place. The arrow had been invented and chasing (probably also warfare) had been sophisticated. The individual huntsman or the group of hunters and the animal (sometimes the enemy) are the major topics. The scenes are very dynamic as they show people and animals running, attacking, fleeing, and shooting. In many cases there is a basic relation, e.g. a huntsman shoots at an attacking ibex, four huntsmen with a leader, or a battle between two groups, etc. We could say a relation or a valence schema is realized in the painting.

The engravings show a multitude of situations in every day life. If hunting scenes are dominant, a number of other social settings are also represented: groups with women, women with children, dances that involve men and women. Probably the social roles were separated between hunters (exploiting the larger ecology) and women controlling the family, the dwelling and the nearby ecology. The change in social structure (if we infer this from the catalogue of pictures) could have two sources:

- The warmer post-glacial period changed the ecology. Instead of hunting large animals and moving with the big herds of reindeers, the hunters exploited the diversity of smaller animals in their neighborhood, the settlements became more stable, the techniques of hunting and exploitation developed further.

- The Levante population was apparently in contact with populations in northern Africa and possibly had a different ethnic substratum.<sup>16</sup> Thus the human bodies shown in the pictures portray ideal persons with slender builds (even women).



**Figure 6.** A bison with symbol-like drawings from the cave Font-de-Gaume and a mammoth with a trap-like symbol (cf Jelinek 1972: 434)

Figure 7 shows an engraving from Cueva Remigia in eastern Spain.



**Figure 7.** The chase at the ipex (Cueva Remigia; cf Weigert 1956: 31)

The Mesolithic art of the Levante culture is so different from the Franco-Cantabrian one that these cultures seem to be both historically and ethnically independent. Possibly both cultures had parallels in northern Africa: the Franco-Cantabrian style resembles the rock engravings in the Sahara Atlas and the oasis Fezzan (south of Tripoli). Between 7000 and 6000 BP cultures based on cattle breeding reached this from Sudan. They continued the same realistic style (mainly with contours engraved in the rock) but with different contents. In a similar way the Levante style is imitated by Mesolithic rock-drawings in the mountains further south: Hoggar, Gilf Kebir a.o. Here the paintings on the rock show pictures of social life in a very vivid although formalized style. Figure 8 shows a family scene found in Kargur Talh.

If we imagine the religious or shamanistic contexts of Paleolithic and Mesolithic art, we may see how the dramatic change of climate may have triggered a basic change of image-schemata. If in the deep and hidden caverns animals (or their souls, the clans they represented, basic natural forces) were the object of worship and magical rituals, the art on the rocks in Mesolithic (i.e. warmer) Spain and in northern Africa concerned rather

the sun, the rain and other geo-cosmic phenomena. This could have reoriented the whole metaphorical and metonymical network which grounds the semantic categorizations found in languages (cf the basic ideas of Lakoff & Johnson 1980). Thus the change would have affected the make-up of the meaning-system (which probably triggered a change of linguistic categorization and of grammar at a deeper level than sound change). The structures often considered as universal, such as image schemata, cognitive models, mental maps, and blending (cf Fauconnier & Turner 2001), may have undergone dramatic changes in the Paleo- and Mesolithic periods (and still today although the slow rhythm of such changes makes it difficult to observe them in a human life span).



**Figure 8.** Family scene in the Levante style from Kargur Talh (northern Sahara; cf Rhotert 1956: 41)

As both cultures in the northern Sahara extended to Sudan, we have a link to one of the first large and historically important cultural systems, the art of Egypt and the invention of hieroglyphs in Egypt. This does not exclude the possibility that other Mesolithic cultures (e.g. in Pakistan and India; cf Brooks & Wakankar 1976) existed and contributed to cultural evolutions in the Indus Valley and in the “Golden Horn,” i.e. Mesopotamia and the areas west (Palestine), north and east of it, but it is clear that the Paleo- and Mesolithic cultures did not disappear without leaving deep traces in subsequent human civilizations.<sup>17</sup>

## 2 The topology of Cro-Magnon life space and the semi-otic space of decorated caves

The term “life-space” as denoting the basis of human cognition was introduced by Kurt Lewin, who observed the quickly changing perception and interpretation of space as a soldier in World War I (cf Wildgen 2001b). “Life-space” or “cognitive ecology” refers to the relevance pattern, the “meaning” given to aspects of the surrounding space insofar as it is cognitively marked as a memory-system for what we have lived through, experienced, enacted, imagined, hoped, and feared. These contents are attributed to spatial characteristics in a natural way.<sup>18</sup> If in the first step of this process, real places receive memory traces, in a second step the memory-space becomes purely internal and an artificial (cognitive) space is constructed to receive and elaborate the mnemonic structure. I will first consider the evolution of objective spaces used for memory traces and then consider more abstract construed spaces. If we consider the life-space of Cro-Magnon hunters, two regions are most relevant:

- The *space of hunting*; it consists of the habitat, the migration routes of bison, aurochs, reindeer, etc., the caves of bears and lions, the rivers rich in fish, etc. Together with this hunting space the sky with the motion of sun, moon and stars was probably semiotically organized as a memory-system of spatial orientation (B1).
- The *space of shelters*, abris, cave opening, where the clans stayed for certain periods of the year (B2).

These two base-spaces, B1 and B2, which subdivide the social life in an external (open) and an internal (closed) one, may be blended or transformed in ritual, religious contexts. Thus, the space of the sacred, magical, and ritual is one derivation, the space of burial and life after death another one. This allows us to state two hypotheses:

The space for rituals and magic is derived from B1 and B2. Thus, the painted caves are a derivation of decorated abris, cave entrances, by their transfer into dark and hidden (normally not accessible) caves. We call this transferred space, the *ritual space* (R).

The space for burials was in most cases not in closed caves, but rather in open space. Nevertheless, these places could be blended with space R, e.g. in Neolithic dolmens an artificial closed space covered with soil is placed in open space but construed as a closed space. The Egyptian mastabas and pyramids correspond topologically to this type (are open, visible

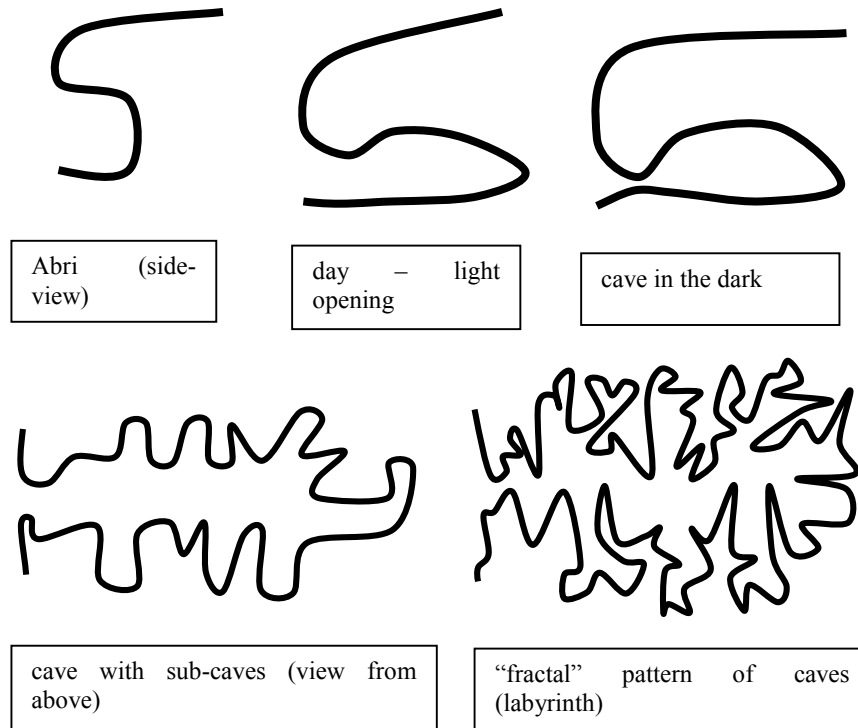
architecture with a hidden cave inside); the burial caves in the Valley of Kings in Egypt are also of the same type as the mountain above was considered as a natural pyramid.

The internal structure of the natural and the construed caves has topologically (ignoring all the topographical details) the shape of a closed tunnel, which may be broken up by sub-tunnels.<sup>19</sup> Figure 9 shows the transformation from the concept of “abri” (shelter) to that of a labyrinth tunnel.

The internal appearance of closed caves was further fragmented as primitive lamps gave only local views (possibly the irregular light produced the effect of a pseudo-animation of painted animals on the wall). In a certain sense a painted cave is the simulation of a mentally realized space of imagination, memory and fantasy comparable to modern media like film, video or computer games. The local structure of the surfaces, the protrusions, holes, etc., added relief to the construed space and were systematically used by the painters. There were probably preferred paths for the visitors of the cave, i.e. a “hodological path” of scenes, views, and aspects. Rappenglück (1999) tries to prove that a rather hidden group of cave-paintings in Lascaux (Le Puits) gives an astronomical topography in which animals stand for astronomical pictures. The (rare) representation of a bird stands for the sun, the bison stands for the spring and early summer, the wool rhinoceros for late autumn and winter, the horse for (high) summer.

The four animals horse, bison, rhinoceros, and mammoth also represent geographical directions (north, east, south, west). Leroi-Gourhan (1981) tries to show that the distribution of animals on the ceiling of the main cavern in Altamira has a formal structure with the 16 bison in the central field and other animals in the periphery. He interprets the animals as symbols for the sexes, whereas Freeman (1987: 72) prefers a realistic interpretation. The central herd of bison has a distribution of sexes and “corresponds precisely to what one would expect had the artist intended to depict a herd in breeding condition” (ibid: 77).

Leroi-Gourhan (1992: Ch III) presents a statistical analysis of the specific place for different animals (a total of 1.386 mammals depicted in 62 caves of the Franco-Cantabric area) and of their collocation (in pairs). A syntactic (sequential) organization is the result of this analysis. The author shows that the animals chosen for depiction are different at the entry, the central painted surfaces and the deep end of the cavern. In the mid-cave different animals occupy the center and the periphery (often they are smaller). The central panels show: 310 bison (93,0%), 464 horses (83,0%), 102 mammoth (92,8%), and 101 aurochs (92,0%).



**Figure 9.** Topological and fractal structure of possible caves

These four classes are the constituents of the central area and dominate it (with 83% to 93% of their total distribution). The back of the caves shows: bears (75%), lions (56%) and rhinoceros (66%), whereas the entry is dominated by deer (48%); the ibex occurs more often in the periphery of the central panels (52%), in the back (27%) and the entry (18%). Other animals are rather evenly distributed over the four zones: wild goat and reindeer.<sup>20</sup>

The painted cave is not just a mental construal, the pictures have a syntactic and a rhetorical organization,<sup>21</sup> which distinguishes the beginning, the center and the end (result).

As a summary one can formulate two semiotic principles:

- *Principle of blended space.* The cave is a blended space referring to an external and an internal base space (B1 and B2), with a specific orienta-



tion (preferred paths) and an exploitation of local reliefs and the illusion of animation produced by flickering light.

- *Principle of functional and syntactic organization.* The choice of themes (animals) and their arrangement shows a quasi-narrative structure (beginning, climax, end) and a separation of center and periphery (comparable to valence pattern in syntax).



Figure 10. The group of animals in the central cavern of Altamira

The symbolic interpretation of the single figures is still controversial, i.e. the lexicon, which specifies the definition (meaning), the function, and possibly multiple readings of an item cannot be reconstructed (different theories can only be structured guesses).

### **3 Living and moving forms in the classical cave-paintings (Chauvet, Lascaux and Altamira)**

In the following only the effect of apparent motion, animation, i.e. the dynamic aspect is considered. I assume that the categories of motion and causation are fundamental for the understanding of all semiotic processes (cf Wildgen 1994, 1999a) and will, therefore, consider their role in Cro-Magnon semiotics.

The oldest cave with high-level painting yet known is the cave Chauvet in the valley of the Ardèche (confluent of the Rhône north of Orange). Different periods of visitation are dated between 31,000 and 27,000 (23,000) and thus belong to the aurignacian (cf Table 1).<sup>22</sup>

Motion and dynamics are expressed and represented in different ways:

- The choice of the angle of view: plain profile or half-profile. Moreover, one part of the body (e.g. the head) may turn in a different direction.
- Figure 11 shows a rather extreme example from the cave Chauvet: a bison turns his head almost 90°, thus directly facing the spectator. Usually the whole animal is shown in semi-profile, so that four legs are visible and the moment of locomotion may be represented (by the relative position of legs).
- Motion can be attributed to the legs as primary instruments of locomotion. The particular position of the head can also indicate forward locomotion. The group of lions in Figure 12 represents the head positions and legs in a group of attacking lions. In another painting more than four legs are visible in a bison (7 or 8), which could represent very quick movement (it is facing a lion, cf *ibid*: 76f).

Many animals form groups or herds in motion. The juxtaposition of animals of prey and predators, e.g. horses and lions may evoke a chase and if the animals stand for humans (as prey [*no plural in English*] and predators), a chase or battle scene may be inferred. The periods in which the

paintings were made span an extremely long range of time. One cannot be sure if this effect on the viewer was intended by the painters, or if they just filled the empty space left by prior generations. In some clear cases two animals show a typical battle scene as the two rhinoceros in Figure 13.



**Figure 11.** A bison turning its head (attacking); cf Chauvet, Deschamps & Hillaire 1995: 107

From a semiotic perspective, which links pictorial and linguistic sign usage, two types of generalization may be considered (stated as principles but still hypothetical).



**Figure 12.** A group of lions (cf Chauvet, Deschamps & Hillaire 1995: 101)

- *Principle of motion first.* Although pictures and lexical items are basically static entities, the semiotic message conserves traces of the dynamics by selecting characteristic phases, which allow the rough reconstruction of processes.
- *Principle of dynamic metaphor.* The locomotion, action and interaction represented by pictures (and verbs, sentences) create a basis for dynamic metaphors.

The central attributes may in a kind of physiognomic argument (cf Wildgen 2001a) be attributed to humans or clans. The list in Table 2 is just a guess, which illustrates this principle.

As Cro-Magnon men/women were mainly hunters (80% of their food was meat from hunted animals), the lexicon of animals is a natural classification of human qualities, of prototypical characteristics. These features may have been (and probably were) attributed to extant individuals, to groups, and possibly to clans and sub-societies.



**Figure 13.** Conflict scene with rhinoceros (cf Chauvet, Deschamps & Hillaire 1995: 64f)

Animal which is strong, dangerous (e.g. lion, bear, rhinoceros)	→	Strong human, who is respected protagonist
Animal (herbivore) which can resist predators but is not a predator (e.g. bison, horse, mammoth, aurochs)	→	Resistant, defensive human agonist
Commonly hunted animal	→	Food for humans helper, object

**Table 2.** Examples of an interpretation

As a lexicon of collective values they were the natural basis for magic, rituals and later for religions. Patterns of locomotion are not only relevant for the content of pictures but also for their production.

As Wildgen (1999b) has already shown, hands may be used as simple models for self-representation and for the organization of parts of the lexicon of nouns and verbs. Beltran et al (1998: 72) have shown that painters in the cave of Altamira stood with their left arm on the cave wall and traced along it to get a long curved line; i.e. they used their (left) arm and hand as a mold for lines. In a similar way the natural motion of the arm with fixed body was the basis for larger curved lines, e.g. the shoulder and back of a bison, i.e. the body parts and extremities were used as instruments in a ritualized act of painting. The drawing of a bison can thus be decomposed into a series of natural motion patterns, which begin at the head and end at the hind legs (variants of this technique are common). As in writing systems the natural motion patterns of the hand, the arm are the dynamic constituents of the lines in the painting.

The surface can be further structured by lines which separate light and dark parts, or by areas with different color or texture and further details can be added. In this context it is worthwhile to note that certain body parts of animals receive special attention: the hair of a bison or its eye and nose (in Altamira), the heads of horses (e.g. a sequence of four heads with necks in cave Chauvet) and of lions (e.g. ten sketched or elaborated heads and necks in cave Chauvet; cf Chauvet et al 1995: 60f, 101f). The prominence and importance of body parts may be linked to the prominence of corresponding human body-parts like head, eye, ear, and mouth or to a physiognomic concept of the analogy between animals and humans (cf Wildgen 2001a). Smith (1992: Ch 4) compares the possible ritual background of Cro-Magnon art with a shaman ideology, which considers life-powers in common to animals and humans (e.g. breath).<sup>23</sup> He (ibid: 102f) also gives a reason for the frequent superimposition of figures (mainly of scratched or engraved ones on a wall). This would indicate that the enacting of the drawing was more important than the viewing. The avoidance of superimposition in the elaborate paintings of cave Chauvet, Lascaux and Altamira serves to distinguish between two techniques:

- An easy technique of scratching where the primary scope was the enacting;
- A more formal, specialized technique of illusionist painting (or sculpture) for repetitive/permanent use in rituals or magic (or for other functions; our knowledge is still very spare).

#### 4 From iconic schemata to abstract signs and to writing

Paleolithic paintings contain many signs, which cannot be interpreted as pictures or figures. The transition between iconic signs and abstract signs (symbols) occurs first with very frequent contents. Two human body-parts appear regularly in the paintings and engravings: the human hand and the female vulva.

In the case of the hand the most concrete picture is created either by pressing the (left) hand on the wall and painting the contours (or by spraying chewed color with the mouth) or by painting the hand with color and pressing it against the wall. The picture is really the *trace* of the hand (it indicates the act of touching the wall with the hand). Other tokens abstract the shape of the human hand to a line (a band) with three, four, five branches. In Figure 14 a set of “hands” from the cave in Santian (Spain) is shown.

The relation of hands to their body is metonymical (*pars pro toto*), i.e. one can guess the whole if one has the necessary knowledge, which is easy in the case of the hand (although the picture of the hand may not be sufficient to identify the painter).<sup>24</sup> Many other pictures cannot be linked with specific contents, from which they are derived. Leroi-Gourhan (1992: Ch IX) made an inventory of the Franco-Cantabric signs and distinguished three major classes:

- small signs (e.g. sticks and ramified forms)
- full signs; e.g. triangles, squares, rectangles (tecti-forms), key shapes (clavi-forms), and
- punctuated signs

He comes to the conclusion that all these signs have (lost) their association with the animals represented in the paintings. They are a supplementary code. This is very clear in Lascaux, where signs and pictures are systematically combined into one gestalt and have corresponding sizes (cf *ibid*: 337).

The *small* signs could be derived by “disjunction,” i.e. certain figural features from pictures are isolated, cut off. The general tendency is one of geometrical abstraction. Small pictures as in portable art could have triggered the abstraction. The miniature signs were conventionalized and later added to full-scale pictures in the cave paintings. This is basically the same process as the one observed in the evolution of early writing systems (e.g. in Egypt). Some of the small signs assimilate the form of spearheads, i.e.

they copy traits of their support. Figure 15 shows a selection of small signs; cf Leroi-Gourhan (1992: 336) for a more complete list.

Leroi-Gourhan associates these signs with the male sex (as phallic symbols). Full signs are associated with the female sex. Either they are derived from the form of the vulva, or from a female profile (without head and feet). The signs called “tecti-forms” or rectangular (cf Wenke 1999: 208f)<sup>25</sup> look like huts or shelters and could refer secondarily to the domain of females. Figure 16 shows some examples from Leroi-Gourhan (1992: 319).

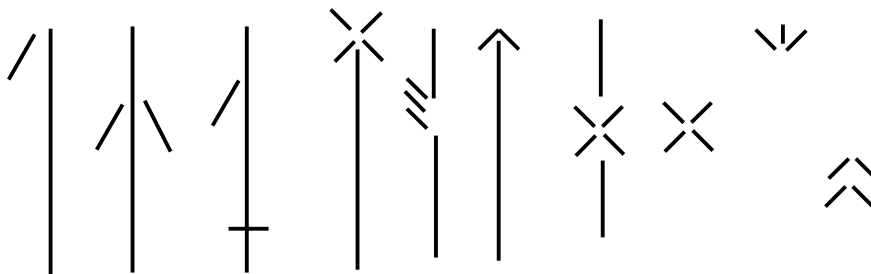
The punctuated signs can be related to a basic technique of painting and engraving, i.e. to aligned points, which produce a curve or two rows of them, which fill a surface. It is thus a discrete variant in the representation of lines and surfaces.<sup>26</sup> There is some evidence that counting or representing mathematical structures may underlie these signs (cf Marshack 1972).



**Figure 14.** Pictures of “hands” in the cave of Santian (Spain); cf Jelinek 1972: 465



A general feature of sign-usage is the fact that, on the one hand, the usage of specific signs is regional, i.e. we observe a diversity of “languages,” while on the other hand certain techniques such as the abstraction from female characteristics are common to large areas (Central Europe). Thus the signs already show a typical pattern in Europe: large leagues of cultures (Whorf’s Average European) and fragmented languages and dialects (some signs appear in areas with a diameter of only 40 km which corresponds roughly to the space of dialects).



**Figure 15.** Examples of small signs.

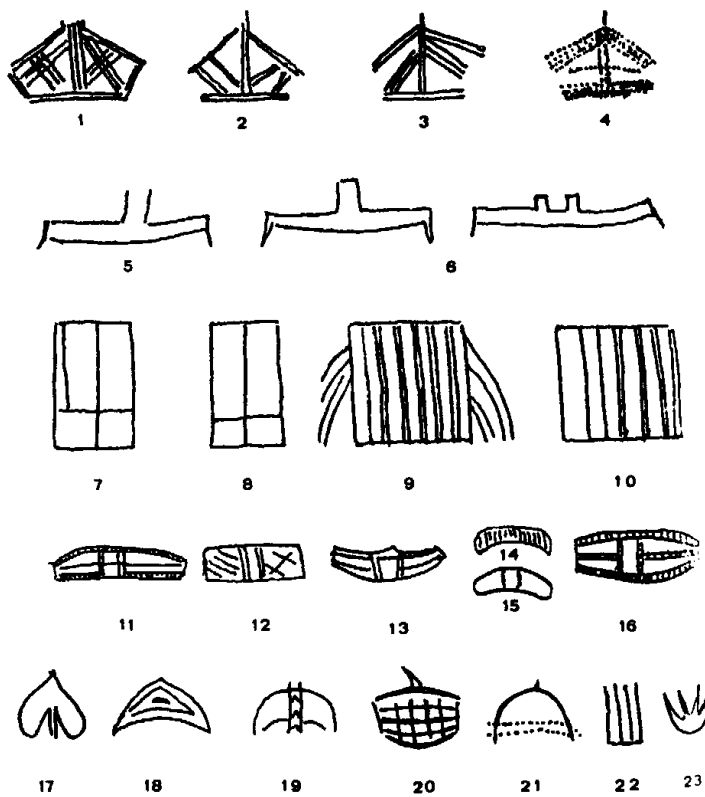
We may summarize these results in two further principles:

- *Principle of sign abstraction.* Forms with a high level of emotional load are selected as the basis of abstraction; the process itself tends to geometrical and mathematical symbols (and prefigures the evolution of writing and mathematics).
- *Principle of regional separation.* With the conventionality introduced via abstraction (which has many possible outcomes), semiotic subsystems appear and thus a fragmentation of the sign space. As some general motivations and trends are conserved, a duality between common European signs and local signs appears.

On the basis of this evolution all further developments are present, even if many traditions were lost and basic techniques, like writing, had to be introduced from the Orient.

From symbolic signs a first pathway leads to ornaments and a second to writing systems, in which the *individual* signal loses its pictorial character whereas the *sequence* of signs still has a content (in contrast to pure orna-

ments). As the Nilotic cultures melted into the civilization of early Egypt, there was continuity (in the Mesolithic period) between Paleolithic art in Northern Africa and early writing systems (e.g. in Egypt). The hieroglyphic characters are pictorial (although schematized) and sequential, i.e. they are at the level of semi-symbolic signs in the hierarchy. As soon as signs for a word with one consonant were used as signs for this consonant, a consonantal alphabet could be created.



**Figure 16:** Examples of rectangular (tecti-form) signs.

The basic operations needed to achieve a consonantal alphabet follow a simple strategy:

- First, reduce the correlation of the graphic sign to a part of the phonetic shape of the corresponding word. If the corresponding language marks variations in the morphological paradigm by changing vowels, the consonants are the invariants of the word family. If the word has only one consonant, there is a clear map from the picture to the phonetic segment (the consonant).
- Second, recombine the signs as “pictures” of the sequence of consonants.<sup>27</sup>

Both operations presupposed an awareness of spoken language. In the context of multilingual communities meeting in the valley of the Nile (forced to move by climatic change in the areas north and east of the Sahara), the conditions for a metalinguistic awareness, or language consciousness, were met. The deeper source for the evolution of writing was therefore the transition from spoken language as an unconscious routine of communication (learned only in early childhood which leaves no traces in individual biographic memory) to metalinguistic awareness, linguistic consciousness. In the same period the confrontation of different religious and ritual (mythological) traditions created a meta-religious awareness and an effort to reorganize the system of religious traditions. Myth and language, the basic symbolic forms in Cassirer’s philosophy, underwent a dramatic change (probably in Mesolithic Egypt). As a consequence writing became a deeply religious technique: This religious, ceremonial character stopped the inherent trend towards an alphabetic writing which was only fully realized by the Semitic populations at the rims of the Egyptian civilization. The western Semitic and the Phoenician alphabets were late consequences of the contact between oriental civilizations in the “golden crescent”: Egypt—Mesopotamia—Indus.

The abstraction process from pictures to writing symbols corresponds to a general mnemonic principle. This is also valid for messages in an object language employed by Yoruba tribes and in Australian messenger-sticks. The message is coded for the messenger, who “reads” it when he arrives after a long journey. This guarantees that he does not forget important contents, but it presupposes that he knows the message. This means that the written message can only be “read” accurately if the reader has a knowledge of its contents independently from the “written” document (cf Friedrich 1960: 17).

Full-fledged writing-systems presuppose a writing industry, i.e. the frequent production and usage of writing in proper contexts. The Paleolithic stone industries established the context for the manufacturing of functionally optimal artifacts (weapons, tools), the Mesolithic and Neolithic picture

and symbol industries established the necessary context for writing systems and optimal communication across larger distances (times) and in larger societies (with distributed roles and functions).

The communicative/functional usage of writing was systematically developed in Mesopotamia, which became a melting pot of many cultures and concentrated large populations into one organized political system. The paths for the exchange of goods, values, and ideas became complex and difficult to control. The civilizations of Mesopotamia (and the “golden crescent”) took their new shape between 11,000 and 8000 BP. The first “token” systems, called “object languages” by Schmandt-Besserat (1978), appeared ca during this area and were not dramatically changed for almost five millennia. Only in the Bronze Age, between 7500 BP and 5100 BP, did the number of tokens increase and their shape differentiate and finally give rise to Sumerian writing (ca 5000 BP; cf also Friedrich 1966: 42f). The context was not religious but economic. The storage, transport and control of goods motivated a system of bookkeeping. A closed jar contained a number of symbolic objects, which stood for the goods sent to a destination. On the jar, a list of the symbolic objects in the jar was marked. This system had two levels:

- objects (e.g. sheep) are represented by object-symbols in the jar
- the content of the jar is listed in planar symbols on the jar

Thus, step-by-step, symbolic objects come to represent the objects sent, received, sold, etc., and signs on the containers represent these symbolic objects. The recipient could assemble these messages in order to keep track of what he had received and he was able to transfer the symbolic objects across different categories: from received to sold, dead, lost, etc. In this manner the symbolic objects and the manipulation of them became a kind of holistic mimesis of economic transactions. The representational function is achieved by the symbolic system in its organization and its processing; the single signs may lose their pictorial content, but the representation of the writing system and its processing as a whole is still enriched.<sup>28</sup>

If we look closer at the symbolic objects in the table given by Schmandt-Besserat (1978: 87f) we notice the geometrical and abstract character of the signs: spheres, discs, pyramids, cones, tetrahedrals, biconoids, and ovoids are the basic shapes. On these bases, other abstract geometrical shapes are marked (in a lower dimension): holes, lines in/on the sphere, disk, etc. The Sumerian pictograms later flatten the symbolic objects to two-dimensional shapes.

The direction of writing was first rather accidental, later an organization into vertical columns came up with the order of columns from left to right and inside the columns from top to bottom. Finally the whole arrangement was rotated by 90°; the first column on the left became the first line on the top. In the same move the symbols were rotated by 90°.

The mapping of one word → one symbol was replaced by a syllabic mapping and sequences of (syllabic) symbols mapped into polysyllabic words. As a word (and its sign or sign-sequence) stood for a whole family of words with the same root, determinatives were used to distinguish different word-forms. As only consonantal patterns were mapped into written symbols, the written forms were still ambiguous. There were two major methods of disambiguation:

- By a kind of “punctuation” the vowels could be marked. The method of punctuation was adopted by many civilizations and languages in the Near East (still observable today in Arabic and Hebrew)
- Special symbols for vowels were inserted into the sequence of consonantal symbols. This method was first adopted by the Phoenician (Persian) and later by the Greek, Latin and Cyrillic alphabets

The evolution of writing systems was linked to cultural and economic evolutions, which produced larger, more complex societies, and shaped a synthesis of different religious traditions and different languages. Thus the conditions for effective communication were changed by the growth of the communicative network. Ethnic, religious and linguistic diversity triggered an awareness of religion, myth, ethnicity, and language; these became objects of consciousness and reflection at least for a group of specialists (priests, politicians in the sense of people occupying professional roles in a state).

In the case of the civilizations in the “golden crescent” economy, traffic and administration first created a (poor) system of object symbols and later a very rich inventory of cuneiform characters which soon filled libraries with reports and commercial texts.

Different solutions for the design of writing systems were in conflict and in Europe and western Asia the ideographic systems disappeared and the alphabetic principle expanded in all directions. Only in China did the ideographic writing system survive. It had found its very abstract shape already in the old bone-engravings (1400-1200 BC).<sup>29</sup> The basic economy of these systems has, in spite of its ideographic character, structural similarities with the alphabetic systems:

- The complex ideograms can be decomposed into ca 20 elementary line-configurations. This corresponds roughly to the number of characters in an alphabet (23-30)
- These elementary characters can be combined to form ca 214 different radicals. This corresponds roughly to the number of syllables in an alphabet system

The complete signs are fitted to an imaginary square. Similar tendencies can be observed in Hebraic quadratic letters, Roman capital letters and the “Antiqua” introduced in the Renaissance.

There are, as it seems, basic design principles which govern the evolution of a writing system and which are rather independent from the historical, social, cultural, and political forces which shaped the evolution of writing in its initial stages.

This evolution of writing transformed both the content - *and* the form sides of language. The basic principles may be linked to principles of mental economy, optimality, mnemonic adequacy, cultural universality, invariance in relation to sound change and meaning-shift. The emergence of pictorial art and writing systems altered language dramatically and this is also valid for modern spoken language for which written standards gradually became a norm or at least a control which smoothens natural sound change and meaning shift.

## **5 Is the esthetic function basic for art and language?**

It is an astonishing fact that Cro-Magnon men developed a rich tradition of painting, sculpture, engraving and portable art only in Western Europe. They probably came from the Near East and had previously populated East Asia, but left only poor traces of comparable art in these areas. Some authors link the “creative explosion” in Western Europe to a general scenario of human evolution, although the restriction to specific areas would forbid such a conclusion. Others even infer a dramatic mutation, which created art and language at the same time (i.e. after 50,000 BP). A more plausible theory assumes a sudden evolution or qualitative increase in the cognitive capacity called “theory of mind,” i.e. guessing at and mapping the mind of other people (or animals). The human mind would have changed from the state of “autism” to that of “social intelligence” (cf Mithen 1998: 171-175). It is more plausible that this regional evolution has to do with cultural evolution and more precisely with a large scale organization of Cro-

Magnon societies in Europe related to population density in specific areas and larger networks of cultural exchange. Thus what changed was not the basic esthetic, semiotic or linguistic capacity but the context of its use. Heeschen (2001) shows that the capacity for speech includes a predisposition for play, and art. In small societies the direct use of information procedures via speech may be a taboo, as it is considered too dangerous: Losing face or accepting blame may be mortally wounding and a violent battle may be triggered by plain words. Indirect, veiled speech, wordplay, songs, and narratives were much more apt to transport socially relevant information and cues than statements, directives, or arguments. As a consequence language use became (and probably always was to some degree) an artful technique of allusion, narration, and playing with possible meanings, allowing for interpretations which cannot be fixed.

Now, a language capacity functionally linked to play and art, to the performance of rituals, the telling of myths and stories or jokes, may be sufficient if accompanied by music, dance, and gestured action in small communities. If the community or the networks of regularly communicating groups grows, new forms with more specific norms and standards have to be invented and Paleolithic art is probably an invention of this kind. It does not only presuppose the existence of language itself but the playful, artistic use of this capacity in the context of rituals, religious and communal life in general. The poetic function is, as Roman Jakobson assumed, a basic dimension of human language, insofar it goes beyond the aims of communicating some desire, interest and rather triggers a free play of imagination, creativity and humor. In order to fully understand Paleolithic art we must assume a highly developed verbal art and probably a high level of music and dance performance.

Thus Paleolithic art is not only an indirect proof for the existence of linguistic competence comparable to our own, but it also indicates that the artistic use of language and other symbolic means of communication had reached a very high level 30,000 years ago. This level was probably only reached again in the first civilizations in Egypt and Greece in historical times and thus Paleolithic civilization in Europe predates the high points in the cultural evolution of mankind.

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## Notes

<sup>1</sup> This period begins with the Interglacial after the Riss-ice age (in terms of deep sea isotopes of oxygen, stage 5e: 128-118,000 BP) followed by the severe Würm-ice age, which may be further subdivided (based on deep sea isotopes) into the Early glacial stage (4): 118-75,000 BP and a colder period (3): 75-32,000 BP. It was followed by the full glacial stage (isotope stage 2): 32-13,000 BP and by the

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late glacial (isotope stage 1): 13-10,000 BP. Since 10,000 BP the present interglacial persisted.

<sup>2</sup> New excavations in the Neanderthal cave not only uncovered missing pieces of the Neanderthal man found in 1856, but also a second skeleton which could belong to a Cro-Magnon man who lived in the same cave 40,000 years ago (cf comment in *Spektrum der Wiss.*, 2000/11: 30). A more global Paleolithic record is given in Petraglia & Korisettar (1998) and the rock art tradition in Australia is described in Layton (1998).

<sup>3</sup> The basic type of modern man was dispersed all over the world, whereas the distribution of the Neanderthal man was restricted to Europe and central Asia. Probably the first groups of modern man in the Americas came from Siberia and penetrated into northern America. The evidence we have today indicates that Neanderthal men were more and more concentrated in geographical islands in South Western France and Southern Spain and finally faded out without leaving relevant traces in the genome of modern men. (Results reported by J.-J. Hublin at the symposium on "Paleontological and Archeological Insights into Human Evolution in Leipzig," June 2/3 2002.)

<sup>4</sup> Since the discovery of the remains of *Homo antecessor* in Spain a controversy has existed as to whether *Homo erectus* is in fact the predecessor of humans who migrated to South-East Asia and *Homo ergaster* the predecessor of humans who migrated to Europe and Central Asia and gave rise to Neanderthals. I will not distinguish between the two species in the following.

<sup>5</sup> I thank Ms Bossom Wrede for style correction and comments.

<sup>6</sup> Different periodizations exist for technology, lithic tools, bone tools, dwelling structures and art and symbol systems (cf Gamble 1999: 290f). A more general periodization refers to deep sea records from cores; the dating techniques for artifacts and bones use the conventional C 14, radiocarbon dating, accelerator-mass-spectrography (AMS) and other methods.

<sup>7</sup> Enard et al (2001) show that the reading out of genes and the production of proteins in the human brain differs not only from correspondent processes in other human organs (e.g. liver) but also in relation to other groups of mammalian species (e.g. mice) which are in a similar evolutionary relation to one another as humans, chimpanzees and rhesus monkeys. Thus, the human brain witnessed an acceleration of change via gene expression rather than genetic information per se.

<sup>8</sup> A sign (a picture, a sculpture) can be observed and imitated without temporal restrictions whereas the phonetic form of an utterance is only remembered for a short time; in most cases the structure of the sign itself is forgotten as soon as the message is understood.

<sup>9</sup> This corresponds to the stage of holistic objectivization called "Mythos" by Cassirer and it is not primarily linked to language but to objects and ritual enacting. Later mythical texts may reshape the enacted mythical traditions.

<sup>10</sup> Even the modern “culture” of graffiti may be considered as a follow-up of rock engravings. Personal marks magically establish a symbolic presence of the artists in his ecological niche. Thus it is also a signal of appropriation.

<sup>11</sup> The dominance of female statuettes and female symbols (“vulvas”) was interpreted as the consequence of a more “gendered” society in the Upper Paleolithic. Eventually a more egalitarian society was replaced by a society with social differentiation and a divergence between female and male roles (cf Foley 1991).

<sup>12</sup> With rather negative connotations, Konrad Lorenz (1940) compares the evolution of recent men with the evolution of domestic animals. As in both cases many of the adaptations to natural ecologies are lost, he calls this “self-domestication of man.” In the context of our argument we would rather say that the evolution of man enters a phase of self-reference. The ecology to which he has to be fitted (in a Darwinian sense) is more and more defined and shaped by man himself. Thus the process of Darwinian fitting becomes self-referential. This could theoretically have the consequence that the process would run to chaos and not only destroy the natural ecologies but also abolish all realistic adaptations to the world persisting outside human control (see Wildgen 1998a for the application of chaos-theory to semantics).

<sup>13</sup> One hypothesis on the rather quick overwhelming of Neanderthals assumes that they formed rather isolated and separated groups without a larger cultural network. Cro-Magnon men/women were organized into interrelated clans and shared a “civilization,” in which innovations could expand quickly and efficiently and which formed a coherent whole.

<sup>14</sup> In Neolithic Spain highly specific forms of schematic art, called “arte macroesquemático,” evolved on the Mediterranean coast (e.g. Conjunto de Pla de Petracos; cf Sanchidrán 2001: 369-380).

<sup>15</sup> Sometimes they appear in hidden places, are mixed with animal forms (like ghosts or masks) or look like caricatures.

<sup>16</sup> In historical times Iberian populations lived on the Mediterranean coast, whereas Celts dominated the North of Spain (ca since 500 BC). New genetic analyses, which conform to linguistic distributions, make it plausible that a population from which the Basque people are descended was living in the Franco-Cantabric area and inherited the civilization of Mesolithic inhabitants there.

<sup>17</sup> Rock art is also found in Australia and Tasmania (cf Bahn & Rosenfeld 1991).

<sup>18</sup> The “art of memory” has exploited this natural process since antiquity in order to organize the professional memory of orators (cf Yates 1966; Wildgen 1998b).

<sup>19</sup> One could consider further blends. A cave is like the inner space of the body: mouth (nose) – stomach – intestines or it is a negative of the body itself with head (entry) – neck (narrow entry) – trunk (main room) – limbs (side-rooms). One

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could venture the hypothesis that the topology of life-space and body is the stable background of semiosis. The (catastrophic) transitions to reinterpretations in other (homologous) spaces constitute the proper semiosis beyond perceptual categorization. This corresponds to Peirce's concept of a symbol created by transfer from one sign-system to another (cf Peirce 1865/1986: 105f). The regress of further and further transitions may be controlled by topological invariants or by rather concrete, iconic sign like the representation of animals, which probably have meanings in a sign system beyond a description of contemporary fauna, but are anchored in visual experience (contrary to abstract signs which accompany them).

<sup>20</sup> For a discussion of whether the term "syntax" may be applied to pictorial structures, see Plümacher (1999).

<sup>21</sup> The cave Chauvet discovered in 1994 shows a rather deviant distribution of animals, namely, the lions occupy a major place (in the back of the cave), reindeer are more frequent than usual and the panther and the hyena are exceptional (cf Roudil 1995: 59).

<sup>22</sup> Although the general climatic and ecological conditions changed only with the end of the ice-age (ca. after 13,000 BP), the cultural distance between the population which used the cave Chauvet (around 32,000 BP) and the caves of Lascaux and Niaux (around 16,000 or 15,000 BP) is surely relevant.

<sup>23</sup> Remark by Blossom Wrede: "If it was animal HEADS and HAIR which received special attention, that suggests that the interest in these animals was symbolic or ritualistic, as one cannot eat heads and hair very well – it is not just a picture of a good animal to hunt, but a picture of an animal as himself which must have meant something beyond a food source to the people painting it."

<sup>24</sup> In some cases the hands are deformed (e.g. have only four fingers); they could therefore be the personal signature of a painter.

<sup>25</sup> Beyond a normal form, which stands in an iconic relation to a relevant entity in life-space, e.g. a female contour or a sexual organ (vulva) and a simplified form, one can distinguish derived forms, which recombine simplified forms to form new, more complex entities or invert, rotate, or deform them; cf Wenke 1999: 208 (Figure 4.17, after Leroi-Gourhan).

<sup>26</sup> In Greek antiquity Pythagoras represented numbers by geometrical figures (their corners) and thus conceived a kind of arithmetic geometry.

<sup>27</sup> In the further stages of development, the common meaning of a family of words for which the consonant stands is given up and the pictorial shape becomes irrelevant (i.e. it loses its iconical grounding).

<sup>28</sup> The first symbolic objects appeared 8500 BC in Zagros (Iran); they distinguished four shapes: spheres, discs, cones, cylinders. Together with ornamental modifications twenty types were distinguished. The number of different types

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changed dramatically with the emergence of towns and more densely populated areas in the period 3500 to 3100 BC; it soon reached a total of 660 different types.

<sup>29</sup> It is not clear whether a connection to the writing-systems of Mesopotamia existed in the period before, say, between 3000 and 2000 BC.