Evolutionary pragmatics

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1. Pragmaticism, pragmatics, adaptation and the evolution of language

Historically there is a link between Darwin's theory of evolution (1859, applied to humans 1870) and discussions in the 'Metaphysical Club' at Harvard, which began meeting in 1872 and had William James and Charles Sanders Peirce as members. Their point of view was that pragmatics is Darwin's theory of natural selection applied to philosophy. In a speech delivered in Harvard in 1872 Ch. S. Peirce sketched his 'Pragmatism' as a philosophy based on the practical consequences of intellectual operations. The term 'pragmatic' refers to Kant's "Anthropologie in pragmatischer Absicht". From its beginning, pragmatics had therefore a strong link to anthropology (cf. Kant) and evolutionary theory (cf. Darwin) with its central concept of adaptation (cf. Verschueren & Brisard 2002). Östman (1988) points to different levels of adaptation. One has to distinguish adaptive processes found in animals which shape instincts: "Instinct can be seen as a response to the pressures of natural selection, and it thus functions as a means of preservation of the species" (Östman 1988: 11), and adaptation can have different goals: adaptation to a changing ecology, adaptation to changes in the social organization and cultural context of populations and finally adaptation to new standards of language use. When Whorf describes the world-view of the Hopi, he can point to a divergence in human cultural adaptation, which results from a separation of the Amerindian population from the Europeans some 40 to 50,000 years ago. In sociolinguistics the separation of social classes creates different codes as modes of communication in different social networks (cf. the work of Bernstein and others). On a much shorter time scale, every conversation "creates meanings in addition and/or opposition to speaker's intentions" (Östman 1988: 10). In the following sections, we will focus on the evolution of language and its pragmatic dimensions before the last out-of-Africa migration and the separation of the linguistic families.

While for the pragmatist a gradient transition between communication in animals and language in humans is evident (as it was for Darwin), some currents in theoretical linguistics take the opposite position. Fitch, Hauser and Chomsky (2005) focus the question of language evolution on an "abstract core of computational operations, central to language and probably unique to humans" (Fitch, Hauser & Chomsky 2005: 180), and they try to abstract the "myriad component mechanisms" (p. 181) which are not unique for humans. What is left is called FLN: *faculty of language in the narrow sense*. As they say themselves, FLN "could possibly be empty if empirical findings showed that none of the mechanisms involved are uniquely human or unique to language". For Fitch, Hauser and Chomsky (2005), the best (and currently only) candidate for a component of FLN are "computational capacities of recursion" (p. 204). As only synchronic adaptation is accepted as empirical evidence, all explanations arguing for an adaptive *origin* of this core feature are dismissed and thus any evolutionary explanation of human language is considered to be unscientific (not testable). Jackendoff and Pinker (2005) argue that recursion is also found in the human visual system and thus would not be specific to language (i.e. not part of FLN, which as a consequence would be empty). Moreover the 'narrow syntax'-view of language in Chomsky's tradition is rejected as scientifically unproductive.

In the following we join Darwin's basic intuition that there is a gradual (possibly punctuated) transition between animal communication/cognition and the linguistic competence of humans, i.e. our object is the faculty of language in a broad sense. Nevertheless, specific human abilities demonstrated by the use of language remain the explanatory goal of the endeavor.

The evolution of human cultures and languages seems to be due to rather quick developments (relative to the phylogenetic scale). Two major periods of rapid emergence are plausible:

– The first is linked to the emergence of lithic technology (Homo Habilis) and to the proto-species which was later distributed in Africa, Asia and Europe: Homo Erectus (and its African variant Homo Ergaster). One can postulate that the core of this evolution took place around 2 my BP. (2.4 to 1.6 my).
– The second concerns the archaic Homo Sapiens prior to the second Out-of-Africa migration. We may fix the core of its evolution to the period 200 ky BP (currently the oldest bones associated with Homo Sapiens are 150 ky old, but genetic calculations based on the diversity of current populations lead to a time-span between 400 ky and 150 ky)).[1]

Comparative behavioral research shows that many cognitive and communicative skills were pre-existent to both species and thus to the emergence of language. The list contains at least the tendency towards bigger brains, upright locomotion, ad hoc tool use, call patterns, manual dexterity, and specific brain functions (asymmetry of the parietal areas, forebrain extension, mirror cells). Darwin's (1969 [1872]) assumption

1. New analyses of the genome of three Neanderthal men and a specimen of humans living in different parts of the world showed that all non-African populations share genes with Homo Neanderthaliensis. They intermixed probably in the phase when Homo Sapiens left Africa (between 100 and 60 ky). Cf. Green et al. (2010).

that human language arose continuously from animal expressive and communicative behavior has to be revisited, insofar as different neural pathways are used by primate calls and human language. Nevertheless human language did not evolve out of completely organized grammars (and their semantics and pragmatics). It seems rather that the ecology, the actions of (pre)humans in their ecology, the technologies evolved since the Homo Erectus and the cultural/social advances they allowed, are the proper background on which human language could take shape. In short, the pragmatics of human languages is the platform on which human language was built. For this reason it seems reasonable to call the corresponding field of research *evolutionary pragmatics*.

We shall first expose the evolutionary signification of traditional sign functions, then treat the role of artifacts and lithic technologies for the evolution of symbolic behavior and finally discuss the transitions from ecological to cultural pragmatics.

2. Sign-functions and their evolutionary significance

Cassirer as well as his contemporary, the psychologist Bühler (cf. his *Sprachtheorie*, 1934), assume a critical limit between human and animal sign behavior on the level of sign-functions. For Cassirer the symbolic organization of thinking (giving symbolic form to pre-symbolic thought) demarcates the transition between nature and culture. Bühler's and Cassirer's views are part of the common attitude to Darwinism between 1920 and 1935. Neodarwinism, also called "Modern New Synthesis", which has a solid foundation in genetics, was created between 1936–1947. Studies on the intelligence of higher apes had been initiated in the twenties by Köhler and were further developed in the decades following World War I. It is therefore necessary to reevaluate the proposals by Cassirer and Bühler in the light of more recent results. I shall elaborate on Bühler's proposals in view of an evolutionary structure underlying human sign functions.

2.1 The triad of sign functions

Bühler distinguishes three major functions of signs: *representation* (Darstellung), *expression* (Ausdruck) and *appeal* (Appell). In his view, the function of representation, i.e. systematically organized reference to the world (including sign users) is only achieved by human language, whereas the two other functions are already realized in animal communication. Therefore, *semiotic* signs (as triadic systems of functions) are different from non-semiotic signs (= signals). Later Jakobson (1981: 22–23) further elaborated this triad and made a distinction between *referential* function, *emotive* function, *conative* function (these correspond to Bühler's original triad), *phatic* function (establishing contact), *metalingual* function (telling us something about the code), and *poetic* function (concerning the form of the message). The three functions which Jakobson has added are self-referential, insofar as they concern aspects of the basic triad; we may call them meta-functions (cf. also Wildgen 2009a). In Figure 1 the basic triad of Bühler is illustrated and the metafunctions (Jakobson's three further functions) are added. The function of representation is only clear in some examples of animal behavior and remains very context dependent.

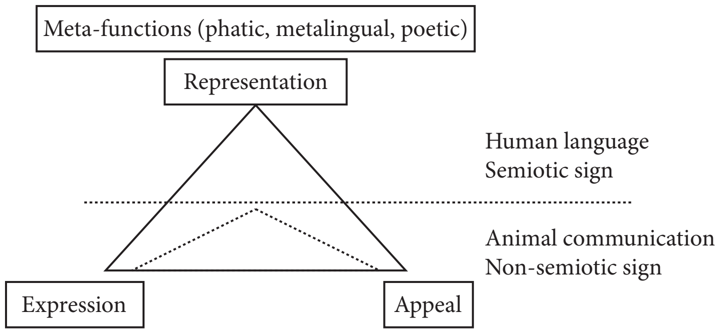

Figure 1. Pragmatic functions and the hierarchy of signs

For Bühler, functions (aims, intentions) are kinds of vital needs and thus presuppose the level of life (of animals). If such needs (or instincts in traditional terminology) are generalized beyond animals and humans, a higher level of generalization can be reached. In fact, the cyclic nature of the schema already became apparent in Jakobson's additions, insofar as any meta-level generates further meta-levels (ad infinitum). But even Bühler's original triad is as such the product of a cyclic process and this cyclic nature makes the triad interesting for a dynamic theory of language use and language evolution.

2.2 The evolutionary interpretation of the triad of functions

The discussion on primary functions of language is part of a larger discourse on vital needs of living beings linked to the question of instincts and their classification (cf. the discussion on "pregnancies" in Thom 1983: 264ff., Wildgen and Plümacher, 2009 and Wildgen, in print 2010). Moreover, the triad implies some kind of intentionality (i.e. a goal which is perceived and realized) and it is therefore rather anthropomorphic, which from the start does not invite its application to animals, which are at a low level of consciousness or social organization. The last two functions, expression and appeal, are strongly linked, because the use (meaning) of expression asks for some receiver and appeal is without effect if no content can be expressed. We can use the label 'social communication' (social calls, grooming, body postures, etc.) as a cover-term for both, and distinguish it from functional referentiality (which first appears in the alarm-calls of e.g. velvet-monkeys). This simplifies Bühler's triangle to a linear opposition. If representation is in its first stages already present in socially organized primates (or even in monkeys), the transition to humans concerns mainly:

– the enrichment of representation, i.e. the lexicon and via self-organization the syntax; and
– the emergence of meta-functions.

The most prominent case of meta-function concerns propositional attitudes and explicit performatives, cf.:

1. I believe that a snail is in the tree.
2. I tell you that a snail is in the tree.

The content of the propositional attitudes and the preformatives: *I believe –*, *I tell you –*, does not concern a state of affairs (in/about the world); it is rather about the speaker, his audience and their social relation. Therefore, it concerns a higher level of meta-social communication.

If in a further step one assumes that representation emerges from ecological cognition (categorization of an ecology) and expression/appeal from some structure of the group (primitive, non-conscious social categorization of behavior), one obtains three inclusive levels, where the inner circle is reached by all animals with a social organization and specific reactions (perception/motor control) to their environment, the middle circle concerns animal communication with a minimal reference to the context and the outer circle encompasses humans (and possibly some primates with self-awareness). The functions in Bühler's triad emerge from ecological categories and from social categories already apparent in animal behavior. They ask for a first level of self-referentiality and consciousness. The meta-levels (only one is depicted in Figure 2) go beyond the emerging self-consciousness and open a range of new behaviors. In this sense the function-triad implicitly contains a cyclic dynamics, in which basic functions of ecological adaptation and social organization (level 1) emerge (via some hypercyclic process which should be further specified) to the new duality of representation versus expression/appeal, which is characteristic of higher primates and humans and probably fully developed in a (proto)language with a basic lexicon. The next step was only reached when self-consciousness and meta-cognition emerged. This presupposes the evolution of control-functions probably situated in the forebrain of humans. The language and other symbolic forms latent in Homo Sapiens populations (core time 250 ky BP) were further evolved via cultural evolution in the last 40,000 years.

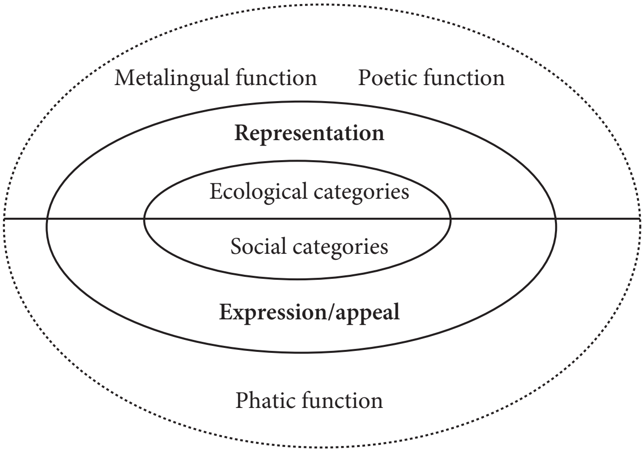

Figure 2. Three levels for the emergence of pragmatic functions

As the processes schematically considered in the last sections belong to macro-evolution, one must ask for the Darwinian criteria of fitness which have driven such an evolution. It is clear that every new level of emergence has increased the (mental and social) costs and therefore one must also find a benefit which can at least compensate for such costs (i.e. which can better make them a profitable choice).

2.3 Selective value of communication and symbolic behavior

All functional models of communication should ask for the survival value of communication, because in a Darwinian framework only the fertility and degree of survival of the species (not its cleverness) counts. As communication is a type of information-sharing, a concept of (strong) reciprocity is needed. Under what circumstances did (reciprocal) sharing of information pay off? According to Fehr and Henrich (2003: 3), "A person is a strong reciprocator if she is willing (i) to sacrifice resources to bestow benefits on those who have bestowed benefits (= strong positive reciprocity) and (ii) to sacrifice resources to punish those who are not bestowing benefits in accordance with some social norm (strong negative reciprocity)." That is, strong reciprocity is produced by between-group selectivity "because groups with disproportionably many strong reciprocators are better able to survive" (Fehr & Henrich 2003: 28–29). Within-group selection favors egotistic behavior. They argue that a population which is often in danger of extinction and must therefore reorganize (and include strangers) will produce a relevant amount of strong reciprocators. As under normal conditions (without the inclusion of many strangers), egotistic behavior is favored, the species will in the long run assemble a stable amount of reciprocators *and* egotists, i.e. the population is ethically bivalent. The sharing of information on the ecology, on one's own mind and on social relations (expression/appeal) would follow from strong reciprocity. It also enforces a level of truthfulness of symbolic behavior. Cheating and lying by means of symbolic forms is, however, an alternative corresponding to the within-group selection of egotists. The equilibrium of both strategies and its stability is a phenomenon which asks for further elucidation.

Another type of functional explanation of language origin based on social evolution and the selection on groups rather than on individuals has been proposed by Dunbar (1997). He found that chimpanzees employ 20% of their time in grooming. These practices are necessary to uphold social solidarity, social roles (hierarchies), to control conflicts, etc.; i.e. grooming is a semiotic activity, a ritualized behavior abstracted from mutual hygiene. In bonobos, sexual activities are also ritualized for social purposes. Dunbar argues that the percentage of time spent on grooming activities depends on the size of the group. If the social organization of the group tends to larger communities, these techniques of solidarity and social peace become energetically too expensive. Vocal communication, chatting, simply construing vocalized contexts of solidarity is an alternative. The most proficient actors in social communication get dominant roles in the tribe and reproduce at a higher rate. A run-away process makes this competence desirable *and* creates the necessary social power. Very soon a population may be organized by selection on communicative, i.e. linguistic competence.

In more recent research (Dunbar 2002) evolutionary criteria are applied to study the mating choices visible in personal advertisement and in history (marriage records in Eastern Frisonia, conflict in a Viking society, and others). Although cultural rules govern the transmission of choices over many generations, the choices themselves follow criteria of an evolutionary game with the number of offspring and their chances for survival as guiding criteria.

From these discussions it becomes clear that the functions language may fulfill are not a constant in human evolution; their change and differentiation could drive the evolution of human language. In Section 3 I will rather turn to the evolution of human symbolic forms (cf. Cassirer 1957 [1923]) and ask whether more practical symbolic forms, like technologies and art, are able to shed some light on the evolution of our language capacity (cf. Wildgen 2004: Chapters 4–6).

3. Can the pragmatics of tool production and tool-use tell us something about the origin of language?

The first stone axes were produced around 2 my; they make up the so-called pebble culture.[2] The pebble culture requires the use of a stone or bone to chock (another) stone,

2. Chimpanzees may use a stone to open a nut; cf. Chapter 4 and current research in the group directed by Christophe Boesch at the MPI "Evolutionary Anthropology" in Leipzig. Table 1 in Boesch and Tomasello (1998: 593) classifies the "semiotic" behaviors in six chimpanzee populations. The group-specific learned behaviors are also called a "culture".

in order to produce a sharp edge on the pebble; i.e. the tool is used to produce a specific shape and is fitted to a large number of uses. Probably other materials (bone, wood, and fur) were in turn shaped using the primitive stone axes.

If fire had to be conserved (as in populations found in Tasmania and Australia, which conserved rather than reproduced fire), the process of fire had to be controlled. In both cases, it was necessary to master control of causation and instrument use (with an iteration of processes of cause-effect control), as well as its precondition – a *representation* of possible effects, shapes and functions. The "Homo Faber", as Bergson called man at this stage, had the cognitive abilities for symbolic representations. The question is: Did he use phonetic language to express these representations, or gestures, or neither of these? Some authors favor a motor origin of language, and thus stand in the tradition of Condillac's 'langage d'action' (cf. Hewes 1977, who distinguishes a gestural/semantic and a full vocal language; and Quiatt & Reynolds 1993: 266ff.). In this perspective, the (proto)language of Homo Erectus populations would have been gestural (with holistic phonation as a supplement).

Artifacts are not only hints at the cognitive level of humans, they are also linked to social life. In order to produce artifacts and to keep fire, a socially organized exploitation of the environment, a division of labor and a mode of social distribution of products must be in place. This requires rules of collective behavior, and language is the prototype of rule-governed social behavior; it not only helps to represent and enact social behavior, but it is *the central* symbolic representation of social behavior (cf. also Habermas' 1982 'theory of communicative action').

3.1 Instrumentality in higher mammals and man

The use of instruments and the goal-oriented adaptation (manufacturing) of tools can be observed in many orders of animals: ants (insects), birds, and mammals all use simple instruments. In some cases, this allows them to access difficult areas of their body (elephants) or to reach under surfaces. Chimpanzees shape twigs to facilitate 'fishing' for termites in termite-hills (cf. Immelmann 1979: 128). The use of instruments may be inborn and even the evolution of limbs may be connected to instrumental functions, i.e. limbs are 'shaped' evolutionarily to adapt to specific instrumental functions. Thus, primate and human hands take over functions originally located in the head (mouth) for attack, defense, preparation of food, for mastication, etc. Our gestural language, facial expressions, and vocal language presuppose a kind of "instrumental" evolution of the human (and hominid) hand and face (cf. Wildgen 1999b for the synergetics of hands and eyes).

The development of tool-use and tool making implies learning, social imitation or even teaching. Tembrok (1977: 186–187) distinguishes six levels, or stages:

1. ad-hoc tool-using (but cf. Davidson & Noble 1993)
2. purposeful tool-using

3. tool-modifying for an immediate purpose
4. tool-modifying for a future eventuality
5. ad-hoc tool-making
6. cultural tool-making

The last stage, "cultural tool-making", can only be observed in primates and in man.

In a certain sense, human cultures are represented by the production of permanent tools, the techniques of their usage and the social organization enabling and supporting their use. The precise use of tools becomes apparent in the throwing of shafted hand-axes, and later in the use of arrows.

In the evolutionary line of primates, tool-use is reported both for new world apes and old world apes. The former show only the behavior of throwing objects (from above down to the bottom of trees) in attack and defense, whereas the latter show a higher diversity of tool uses (cf. Becker 1993: 79–110). Rather sophisticated tool-use with beginning tool modifying is reported by Boesch (1993), who describes the nut-cracking behavior of wild chimpanzees of the Taï National Park (Côte d'Ivoire). The animals transport both nuts and hammers to roots, which are used as anvil. As stone hammers are rare and necessary to crack very hard nuts (Panda oleosa), they are transported and preserved. Wooden hammers may be shortened using fallen branches until they fit. Infants must learn the use of tools, and different ways of passing on the proper method of use have been observed: *stimulation* (e.g. leaving the hammer near a nut), *facilitation* (providing good hammers and intact nuts), and *active teaching* (Boesch 1993: 173–174).[3] Another type of tool use by chimpanzees is called 'leaf sponging', i.e. wild chimpanzees drink rain water from the hollow of the trees using leaves.

Although not all chimpanzees in all ecological environments show these types of tool use, one can say that they are able under proper circumstances to develop a system of stable tool use and even tool modifying. A moderate amount of teaching of tool-use is possible without the use of language but complicated actions or their perfect enacting require special linguistic tools; this is clear in the case of normal musical education or high level athletic training. A simple level of tool-use and tool-making does not require language and the immediate question is whether language was a necessary condition for the further evolution of tool-use, beginning with stage four in the list above, or whether the general (social) evolution, which demanded an enabled level of 'cultural tool-making', had the existence of a language as a (social) precondition? A third possibility would be that tool-making at stage four demands planning beyond the present and at further stages the control of a series of goal-oriented activities, i.e. in a sense a *syntax* of manual activities. The production of tools becomes a part of a larger set of social practices, i.e. tools found by archeologists are only indicators of a

3. The oldest nut-crackers of chimpanzees found are dated to 4300 y BP; as no human population lived in the neighbourhood at that time, the technique could not be borrowed from humans.

very complex social and cognitive interaction. Thus stone tools of a certain material and size presuppose knowledge about places where one finds the material, a mental geography of proper resources. The stone tool in use can help to shape other tools of wood, horn or bone; these again are helpful in manufacturing clothes, parts of the furniture and dwelling.

On this view a stone tool is only the single remnant of a whole system of cultural traditions, which were learnt by children, taught by adults and assembled in the memories of the older members of the clan together with the stories of the family and the clan (of the world and the spirits possibly). One can easily imagine such a social complex if one considers the embedding of basic manufacturing techniques into the community life of Australian aborigines (cf. Reynolds 1983).

Another key to the evolution of tool-use and language is possibly cerebral lateralization, which is a long-range tendency in primate evolution:

> For example, hemispheric specializations similar to those that characterize *Homo Sapiens* appear to be present in macaque monkeys (Macaca) who are left-hemisphere dominant for processing species-specific vocalizations […] and right-hemisphere dominant for discriminating faces. (Reynolds 1983: 224)

In the course of the evolution towards man, the left hemisphere subsequently became specialized for right-hand manipulation and bimanual coordination. Thus the evolution of manual skills was responsible for the cognitive ability of planning and coordinating the motion pattern of hands. In parallel, the anatomy of the hand changed and as archeologists have discovered enough bones of hands, one can deduce from the characteristics of these bones, that

- the Australopithecus Afarensis already had a higher mobility of the hand in comparison to chimpanzees living in that period, but that there remains a clear qualitative difference compared to modern humans and,
- the Homo Neanderthalensis of Ferrassie 1 and 2 has specific features which do not coincide with those found in humans, but the mobility of their hands was presumably at the same level (cf. Piveteau 1991: 62 ff.).

The parallel question for an archeologist is: Did Australopithecus Afarensis or Homo Erectus make tools (beyond level 3, mastered by chimpanzees; see above) and was Homo Neanderthalensis as fit for tool making as the Cro-Magnon man was?

The earliest tools are dated to about 2 my BP. They were found in the Olduvai Gorge (East Africa) and show a variety of forms of flaking using pebbles, which had been brought from other places to the sedimentary context in which they were discovered. The basic technique of stone flaking had been discovered and elaborated to a 'culture'. For these cultures, the corresponding findings of human bones received the name 'Homo Habilis'.

The next stage is called the 'Acheulean industry' and is related to the Homo Erectus. The shape of the bifacial hand axes is (at least locally) standardized (cf. Davidson & Noble 1993: 370–371). The archeologists are still debating whether the hand axes or the flakes (or both) were the tools 'intentionally' produced. The stone-industries of late Homo Neanderthalensis (Mousterian industry) improved (perhaps out of rivalry with the Cro-Magnon man) and reached a similar level.

3.2 Is tool-making a pragmatic source of propositional semantics?

Continuing in the line of coevolution of visuospatial scenarios and cognitive-semantic competence, we can compare tool-making scenarios with schemata for simple sentences. The underlying hypothesis is that the semantic structure of sentences is prefigured in visuospatial scenarios as those mastered by early toolmakers (Homo Habilis, Homo Erectus). Such a hypothesis is also corroborated by comparative research on the cognitive development of humans, chimpanzees and monkeys. By testing physical cognition (causality) and logico-mathematical cognition (classification) it was shown that not only are humans quicker in their development reaching the second (higher) cognitive level, but also that humans develop both types of intelligence in parallel, whereas in chimpanzees physical cognition comes first and overlaps shortly with logical cognition around the age of two. In humans the physical intelligence, which is dominant in tool use, can thus co-evolve with logical intelligence. This could be a major precondition for the acquisition of language. At the same time this enables a higher level of tool-use, including several steps, intermediate goals and subtractive (negative) techniques in tool manufacturing. The basic script of tool manufacturing contains the following schemata.

1. Seeking for materials (this may include the cultural transmission of knowledge where the materials may be found, and even trading of materials).
2. Using both hands, such that one hand fixes the material, which has to be shaped, and the other controls a tool used for shaping. This means the holding of both objects and the control of a stroke of the bone-tool on the stone.
3. The products of tool making in the late period (about 30–10 ky BP) were highly differentiated and served many purposes.
4. The tool is adapted to specific contexts; it becomes the blade of a knife, the point of an arrow, the body of an ax, etc., or it is used to perform one phase of a process, e.g. cleaning the fur of an animal; the fur is already the result of a longer goal-oriented process beginning with the hunting of the animal. If a social distribution of functions exists, the tool-producer may exchange his product for food or other tools. It becomes an object of value. The mastering of tool-production allows the production of cultural objects and art; these may again become objects of value.

Elaborated tools and objects of art show geometrical abstraction (triangles, symmetrical or asymmetrical shapes) and iconicity (with abstraction).

5. A further stage produces pictures (signs) of the hand, the 'instrument' which shapes tools.

The last stage points to a first cycle of self-reference. The painter refers (iconically) to the (his) hand, which he uses in painting.

The interesting and new process is No. 2; i.e. a vector-field prescribes the path of the shaping energy from the right hand (R) to the left hand (L). If we magnify the zone of contact, we see the bouncing of the tool on the zone. It has two effects:

- It creates a hole at the point of contact.
- It triggers a shock wave, which may split the zone.

Archaeologists can recognize the goal-directed activity of hominids (humans) by the small hole; the intended effect is the splitting and a specific result in certain materials is the sharp edge of the tool.[4]

From the pragmatic sequence, we can derive an "idealized cognitive model" of events (cf. Lakoff 1987: 68–76), which is based on the body schema of human hands and their instrumental use. One can distinguish *simple* and *complex* (interactive) sub-models. The first four sub-models may be called simple:

1. Simple events are linked to one (left or right) hand.
2. Simple events involve some body acting on an individual object (bone, stone, etc.).
3. Simple events are modular insofar as they may be repeated, inserted into other contexts and combined with other events (self-containment is provided by the body).
4. The transmission of force is prototypically asymmetric. One hand (and a tool in this hand) moves, the other hand fixes the object which has to be shaped. As the shaping instrument is deformed to a lesser degree, an asymmetric effect is produced.

4. The topic "intention of knappers" is critically discussed by Davidson (2002). He prefers to assume intentionality only for Middle Stone Age knappers. Under this assumption, stone industries would only be an indication of language capacity some 10.000 y BP. As a consequence, language, like other technologies, would be a fact of cultural evolution rather than of biological evolution. This conclusion is contradicted by other facts summarized in Wildgen (2004: Chapters 2 and 4) and would not explain the centrality of language for all existing human populations and the stability of its acquisition.

The simple causal model is insufficient at the level of the basic instrumental action: shaping a stone to obtain a hand-axe (or the flints, which are cut off; cf. Davidson & Noble 1993). One has to consider an interaction between different types of causation:

5. An agent perceives/experiences affordances centered in the objects (cf. Gibson 1966); they have to be respected or exploited.
6. The cooperation of hand and eye (acting and perceiving) is strengthened in an adaptive cycle.
7. The cooperation of right and left hand, of thumb and fingers, is further elaborated.

The simple billiard-ball schema of linear transmission of momentum fails as a causal model. One has to define a concept of causation, which includes:

– cooperation of body and environment, body-centre (e.g. brain) and periphery (limbs, e.g. hands);
– nonlinear-causation, as catastrophic effect after the accumulation of minor causes; and,
– the branching (or diffusion) of effects.

The pragmatics of action with hands establishes a micro-level of emerging pragmatic functions which elaborate the relation between cause and effect. At the macro-level, human housing and house-building is a domain where structures emerge which can be reorganized in human linguistic communication in the shape of space-oriented communication, linguistic orientation in space, and memory of narrative contents related to space.

3.3 Cro-Magnon life space and the pragmatic 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 in World War I (cf. Wildgen 2001). '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. 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 (cf. for the 'art of memory', Yates 1966; Wildgen 1998).

Let us 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:

1. 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 pragmatically organized as a memory-system of spatial orientation (B1).
2. The space of shelters, abris, cave openings, where the clans stayed for certain periods of the year (B2).

The two base-spaces B1 and B2 subdivide social life in an external (open) and an internal (closed) one, and 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 three major trends:

1. 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).
2. 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 (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.
3. The internal structure of the natural and the construed caves has topologically (i.e. ignoring all the topographical details) the shape of a closed tunnel, which may be broken up by sub-tunnels.

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 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 2002 [1865]: 105–106). The regress of further and further transitions may be controlled by topological invariants or by rather concrete, iconic signs 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).

4. From ecological to cultural pragmatics

The background of these processes is given by the ecological/situational context. Some objects or context features become *culturally significant*. These are mainly:

a. places (of living, of chase, etc.),
b. tools and the techniques of their use,
c. motion patterns, gestures, gestured signs, dance,
d. sound patterns (music, language),
e. art (engraving, colored surfaces or bodies).

The relevance of places (in space and time), of spatial orientation and categorization are of primordial importance for the semantics of natural languages as the tradition of localistic theories shows (cf. Wildgen 1985: Chapter 1 for a review of localistic case theories). The relational structure of spatial networks is a precondition for migration patterns, contact with neighbors (trade exchange) and the local stratification of human habitats. The micro-spatial categorization is relevant for goal-oriented manual activities like throwing, hitting, but it is also the basis for the manufacturing of tools (cf. Wildgen 2004: Chapter 4). Bodily motion in space and the coordination of spatial locomotion in a group of individuals is the precondition for cooperative chasing and other types of cooperative activities. Finally, external, perceivable processes become the recipients of internal content (in dance, music, gestures, and language).

The cognitive and the social route enter a cycle of coordination, which tends to induce individuals to select cultural contents as cognitive contents and to eliminate a lot of potential contents which are not socially relevant. This strongly selective cycle may be called socio-cognitive. In the two periods in which new behavior surfaced (at the stage of Homo Erectus and of Homo Sapiens), a dramatic co-evolution and selection in the socio-cognitive evolution must have occurred, which has selected humans for symbolic competence. In the co-evolutionary system between a cognizable ecology and cognition/symbolic behavior it seems difficult to find clearly separated levels of increasing complexity. Therefore, the following hierarchy is rather tentative:

a. Already in the last common ancestor of humans and chimpanzees (LCA), contextual space acts as an external memory of affordances, which is indexically given by paths (of social locomotion and predator/prey-locomotion), harvesting locations (and times), dangerous locations, places for sleep, courtship, housing, frontiers of territories, etc. These indexically loaded areas and places function like a catalyst of social action, insofar as they can coordinate social perception and action. Their catalytic nature resides in their substantial independence, as they are just a cognized reason for the overall ecology but are not modified by it.

b. As soon as space is more specifically organized in relation to cognition and social use, it unfolds in a cycle of social "investment". Architecture and the spatial organization of a village (or later a town) are clear examples. This level is autocatalytic insofar as the spatial organization becomes itself a cyclic structure in which different functions cooperate. Figure 3 sketches such an autocatalytic cycle (cf. Wildgen, 2008 and 2009b).

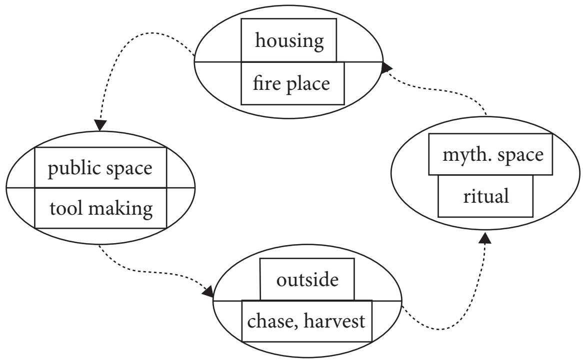

Figure 3. Semiotic/functional subspaces and possible path-ways which link one to the other

In each subspace, specific symbolic media are rooted and co-evolve with them. Thus the Paleolithic cave (in the Franco-Cantabric culture) is a specification of the mythical/ritual space but is connected by its illusionist paintings to the outside space of hunting. The relation is iconic, indexical (in its magical impact) and symbolic (in its abstract signs; cf. Wildgen 2004: 80–83).

In subsequent development, when symbolic modes (e.g. languages and myths) of different populations clash, e.g. in the large Neolithic societies of Egypt and Mesopotamia, a new level of symbolic consciousness is reached. The single fields in Figure 3 reorganize in a hypercycle which produces a new, institutionalized symbolic system, e.g. a codified religion and a written language. Possibly the Franco-Cantabric culture (35,000 to 15,000) and later the Sahara cultures had already reached this level. As the code of its abstract signs cannot be deciphered, this hypothesis cannot be substantiated.

5. Conclusions

The pragmatics of modern languages concern the embedding of linguistic utterances into contexts of use (speaker, hearer, situation, time, etc.) and the action patterns, formed by linguistic utterances (i.e. speech acts, conversational sequences). In an evolutionary perspective, these contexts of action (the ecology, the group structure) become dominant, because language itself is only emerging step-by-step and reshaping, developing the earlier action patterns. At the same time, the social ecology (and later the physical ecology) is dramatically changed by the effect of linguistic thinking and communication.

The field of evolutionary pragmatics focuses on the forces which shaped human language, given the pragmatic and contextual structure of a population which was at the stage of transition to a symbolic culture. This phase probably took a long time, i.e. 2–1,7 million years, and, therefore, the pragmatics underlying human language rather than more conventional symbolic features were the major field of constitutive forces giving rise to human language, and all the complexities found in current grammars and lexicons.

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