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NATURAL ONTOLOGIES AND SEMANTIC ROLES IN SENTENCES

1 STARTING FROM HARTMANN'S ONTOLOGY

My central concern in the treatment of Hartmann's "New Ontology" will be the role of language and other "symbolic forms" (in the terms of Cassirer's "Philosophie der symbolischen Formen", 1923-1929). The major strata (Schichten) in Hartmann's ontology are called "well-know in their contours" by himself.

> "Nun bildet die Mannigfaltigkeit der Formen offenbar ein Stufenreich, dessen Rangordnung im groben wohlbekannt ist: Ding, Pflanze, Tier, Mensch, Gemeinschaft." (Hartmann, 1964: 36)

Although the transitions to plants, to animals and mainly the more recent one to man are highly problematic, there is some consensus that they are relevant as transitions. The transition between man and the community of men or even to historically evolving "Volksgemeinschaften" (ibid.) is highly controversial on one side because the time scale is evolutionary so narrow: from millions of years almost to centuries, on the other side because this transition fails to be inclusive: If man shares features (f.i., physiological and genetic features) with animals and plants this does not hold for the couple: man—community.

In 1933 Hartmann tells us in his "Systematische Selbstdarstellung".

> "Der Gemeingeist ist von keinem Gemeinbewußtsein getragen, sondern nur von individuellem Bewußtsein. Und dieses gerade hat, so zeigte sich, keineswegs die Tragkraft für ihn. So bleibt seine Seinsweise in aller Durchleuchtung des Phänomens eine metaphysisch-rätselrolle". (Hartmann, 1933/1955: 35)

It is, nevertheless, this transition which separates "Seele" (soul) and "Geist"(mind) and circumscribes the area of the "Geisteswissenschaften" to which philosophy and semiotics belong. "Geist" may be characterised as transcendental in relation to the (individual) "soul".

"Er [Geist] transzendiert die Enge der Bewußtseinssphäre in der Mittelbarkeit, im Übergreifen von Subjekt zu Subjekt, in der Tradierbarkeit von Generation zu Generation; so wie andererseits auch der geschlossene Kreis des Einzelbewußtseins seinen inhaltlichen Reichtum nicht aus sich allein schöpft, sondern aus dem geistigen Gemeingut der Lebenssphäre, in die es hineinwächst und an die es sich angleicht". (Hartmann, 1940/1955: 74)

The phenomena pertaining to the stratum of "Geist" (mind) correspond roughly to those called "symbolic forms" by Cassirer. Hartmann says:

"Dieses Seinsgebiet ist das der Sprache und des Rechts, der Sitte und der politischen Bewegung, des Wissens und der Künste". (ibid.)

It would be an interesting endeavour to compare Hartmann's comments on the transition between "Seele" and "Geist" with Cassirer's elaborated philosophy of symbolic forms as an objectivation of the individual thinking, feeling and experience. Such a comparison would have to consider at least the other thinkers between 1900 and 1930 contributing to the same question: mainly Husserl, Heidegger and Carnap; it is, therefore, not possible in the context of this paper.[1]

Both Hartmann and Cassirer take the philosophy of Kant as the point of departure of *modern* philosophy and both are critical towards the "Neukantianismus" of the Marburg-school. Cassirer turns systematically to other sources of knowledge than science in his philosophy of symbolic forms, where he considers language (first volume), myth (second volume) and roughly cognition (third volume). Hartmann mentions three major sources in the establishment of a "new ontology", which has to start from basic human experiences:

"Es setzt die ganze Breite der Erfahrung voraus, sowohl der des Alltags und des praktischen Lebens, als auch der wissenschaftlichen. Ja, man kann hinzufügen, es setzt auch die philosophische Erfahrung voraus, diejenige nämlich, welche in dem geschichtlichen Gange menschlicher Denkarbeit als eine lange Reihe von Versuchen, Fehlschlägen und Selbstkorrekturen verzeichnet ist." (Hartmann, 1964: 18)

To this broad experiential basis is added the critical reflexion (in Kant's sense). This basis corresponds roughly to the one of Cassirer. Cassirer is even more engaged in assembling of current scientific results and in the history of scientific thought (cf. his four volumes: "Das Erkenntnisproblem in der Philosophie und Wissenschaft der Neueren Zeit"). The major

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[1] As many of Hartmann's papers and books were published during the Nazi-regime and after the second world-war, a comparison with Cassirer would have to include the different reactions to this political period. This would show the radical difference between the two thinkers and could illustrate the recent history of German philosophy.

difference concerns the role of mathematics in the sciences themselves (at least since Galilei) and in philosophy (at least since Descartes). In the search for possible general laws and basic principles, mathematics had taken over the role of medieval logics. Although Cassirer is not euphoric when he discusses the application of mathematical thought to the "Geisteswissenschaft" (cf. his article on group theory and the psychology of vision, Cassirer, 1944), he is aware that any quest of universals, basic principles will have to use (or properly develop) mathematical tools. Hartmann seems to restrict the help of mathematics to the domain of quantity and in its application to physics. In his article "Die Erkenntnis im Lichte der Ontologie" (Hartmann, 1955: 149) he shows a diagram where a curve depicts the distance between epistemological categories and ontological categories. Table 1 shows the graphic.

Seinskategorie	Erkenntniskategorie
Geist	Geisteswissenschaften
Seele	Psychologie
Organisches Leben	Biologie
Anorganisches	Physik
Quantitätskategorie	Mathematische Kategorie
Fundamentalkategorien	Fundamentale Kategorien
Modalkategorien	Ontologische Kategorien

Table 1:   Distance-curve between ontological and epistemological categories.

The distance is small for "Geist" and for "Anorganisches", but the reason is a different one. In the domain of "Geisteswissenschaften", language and every day knowledge brings together "being" and "knowledge"; in the domain of physics (quantitative) mathematics does the job.

The fact that since the program of Erlangen (Klein's theory of invariants) and since the rise of topology and qualitative calculus (Poincaré) a new type of qualitative mathematics had been developed, is not acknowledged in Hartmann's philosophy of science. Cassirer, Carnap, Lewin and many others reacted to this evolution in the second half of the 19th and the beginning of the 20th century (cf. Wildgen, 2001). The general systems theory of Bertalanffy, the cybernetics of Wiener, Prigogine's theory of dissipative systems since the 1940th have

proposed unifying, mathematically rooted systems for the problem of multi-stratum categories, which lies at the heart of Hartmann's "New Ontology". The catastrophe theoretic and chaos theoretic models developed in the 70th and 80th followed a similar path. Hartmann's fundamental reflections on ontological strata and transtrata categories and their growing complexity were contemporary to these new developments; but his reflections had no significant effect on them. The innovative impetus of Hartmann's new ontology, which asked to be rooted in current scientific research, was lost insofar as the mathematically organised disciplines originated their own "ontologics" and "categories".[2]

I shall not develop this historical criticism of Hartmann, but propose an ontology rooted in catastrophic theory *and* in a type of general semantics adapted to the formal schemata put forward in catastrophe theory. In a first step I will sketch some ontological presupposition implicit in such a treatment and relate it to Hartmann's critical "new ontology".

The central conceern of dynamical models of the world, the mind, human languages, is the processual aspect. In this we are still in accordance with Hartmann, who says (pointing to presocratic philosophers):

„Das Werden ist vielmehr die allgemeine Form des Realen." (Hartmann, 1955: 99)

It cannot be reduced to states and transitions between states:

„Und eben darum geht das Wesen des Prozesses auch wiederum nicht in der Auseinandergezogenheit der Stadien auf. Die Stadien sind nur flüchtige Durchgangsstadien, Augenblickzustände; aber indem die Zustände kommen und gehen, beharrt der Prozeß." (Hartmann, 1955: 100)

In the domain of cognition (i.e., on the stratum "Seele" in Hartmann's hierarchy) the process character is also basic:

„Als Bewußtseinsform ist der Prozeß eine eminente Anschauungs- und Erlebnisform, keineswegs erst eine Form des eindringenden Begreifens." (ibid: 101)

My strategy in the following will be to consider first the conditions for the identity and the categorisation of processes in general. To this concern the results of catastrophe theory will be used. Second, processes can have different substrata, forces, etc., which materialise them. Any such interpretation of the mathematical form (f.i., a type of catastrophe, or a schema derived from it) implies an ontology. If we move to language, the concept of sign or representation

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[2] In the more technical context of computational linguistics specifically in "Natural Language Processing" (NLP) "ontologies" fulfill functions, like: organizing 'world knowledge', 'organizing the world itself", etc. (cf. Bateman, 1992).

implies an ontological heterogeneity, i.e., two, three or more strata, elements of which are correlated in the sign (i.e., the very concept of representation as such implies a stratification). If we consider a triadic sign structure, then three strata have to be distinguished:

- the stratum of the referent (in the world),

- the stratum of the interpretant (individual or social consciousness),

- the stratum of the representamen (of the body, the sign itself).

In the case of linguistic signs basic realizations are acoustic processes (correlated with organo-genetic, auditive and mental events), writing, gestures and many technical transformation of them.

As the semiotic discussion since antiquity shows, the ontological strata underlying sign-usage are highly controversial. If we adopt a triadic structure, we choose the most plausible one, but a definition of the sign cannot be used as an a priori discussion from which an ontology may be derived. We can only accumulate evolutionary, cognitive, sociological arguments in favour of such a stratification.[3] The basic scenario is given in Table 2. The underlying invariant is the notion of process (cf. above).
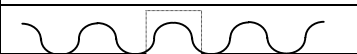
natural processes in the world	perception, memory	sign, language,
local *stabilities* define archetypes and processual things	local *stabilities* are recognised as recurrent process types and things	local *stabilities* and recurrent types specify phonemes, words, sentences, etc.
A	**B**	**C**

Table 2:   Triadic extraction of stability (unity) from processes.

Ontologically the three components in Table 2 overlap, as the identification of phonemes or words in a sound flow is basically of type A. It is the specific tuning of the recognition process to one language which constitutes a phenomen type B.

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[3] The basic question remains if a proper ontology can be found by "accumulation" of relevant criteria. In NLP-research three types of ontologies are commonly distinguished: a (non-linguistic) *conceptual ontology* based on common sense or other criteria, an *interface-ontology*, "an abstract organization underlying our use of grammar and lexis" (Bateman, 1992: 7), and a *mixed ontology* combining an abstract semantico-conceptual representation of real-world knowledge that also functions as a semantics.

The results of language learning (type C) shape the cognitive structure of individual perception and memory (type B) and the stable recognition of things and event-types (type A) allows for a system of meanings and the correlation of meanings with sign-events (type C). The complexity of these interactions was acknowledged by Hartmann insofar as the "Idealsphäre" on one side and of the "Realsphäre" intersect. Specifically in the area of intersection related to "Seele" and "Geist" the "logische Sphäre" and the "Erkenntnissphäre" cover one another. In the zone of maximal intersection all four domains interact as Figure 1 shows (cf. Lichter, 1964: 58).
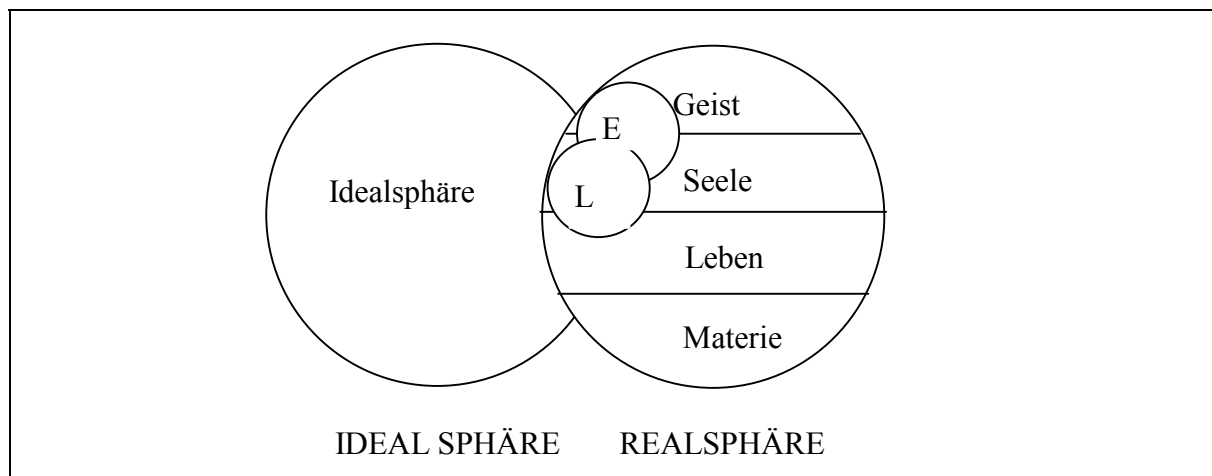

Figure 1 : Modes of intersection in Hartmann's "Kategorialanalyse".

2 THE ROLE OF ONTOLOGIES IN A PHILOSOPHY OF THE MIND AND LANGUAGE

Hartmann arrives to the specific perspective he takes by reintegrating the subject (of cognition, judgement, knowledge) into the ontic world as a proper part of it. Nevertheless, the problems of epistemology raised by Descartes' scepticism and Kant's "critique of pure reason" are still present. In his "New Ontology" Hartmann considers a duplication of the ontology, which contains the human mind and its stratification in the sphere of the mind ("Geist"). The duplicates which are now "objects" of cognition, knowledge, are called *contents* ("Inhalt"). They focus on new structures based on correlations ("Zuordnung"), a scale of knowledge ("Erkenntnisstufen"), beginning with simple perception and ending with comprehension ("Begreifen"), science and critical self-control (cf. Hartmann, 1964: 109 f.). Qualities belong to the basic epistemological stratum (ibid.), whereas categories (in the sense of Kant's table of categories) are bound to the generality only reached in the judgement. This duplication triggers the problem of correspondence between *real* categories

("Realkategorien") and *content* categories ("Inhaltskategorien"). There are basic differences: the infinity and continuity of real space and time is reduced to finiteness and discreteness in the content categories. Perspective, selectivity and vagueness are general types of deformations characteristic for the correspondence relation. His new ontology opens the way for a *differential* analysis of existing categorizations, which had been a forbidden terrain in traditional treatments of the problem (ibid: 113).

The differences between levels of categorization become even more dramatic, if one considers the linguistic nature of human judgements and of the corresponding knowledge structures and the diversity of languages in the domain of lexical categorization. The apparently simple mapping between real categories (in Hartmann's sense), content categories, linguistic categories, and specific categorizations in the lexicons and grammars of natural languages is lost, if we leave the abstract level of a quasi-universal epistemological sphere. Hartmann did not dare to enter this area of complication, and, in this respect, he is a true follower of Kant. Herder had already challenged Kant's language-free treatment of epistemology in his "Metakritik" and Cassirer took up this controversy in his "Philosophie der symbolischen Formen".

Before I propose an integrative view of ontology in section 3, I will just mention three developments which were prior, contemporary, and posterior to Hartmann's new ontology.

a) In his "Der logische Aufbau der Welt" (1928) Rudolf Carnap proposed a hierarchically organized "Konstitutionssystem" inspired by Husserl's phenomenology. For him the act of cognition and comprehension is the starting point from which an ontological stratification may be derived (he would not call it "ontological", however):

   - objects in the own mind (the phenomenological starting point),

   - physical objects (contents of the mind with reference to the world),

   - objects belonging to other minds,

   - abstract objects (e.g., culture, society, religion).

In Hartmann's perspective the content categories are the starting line, then the different spheres (matter/life/soul/mind = "Geist") are assessed. Although Carnap's position seems to be opposed to Hartmann's it could be a variant under the perspective of the subject of cognition.

b) Under the influence of gestalt-psychology (e.g., the concepts of valence and field; cf. Wildgen, 2001), Gibson and the school of "ecological psychology" (cf. Kelso, 1997) developed another perspective, where the psychophysical interface is the turning point from which external reality/other minds and internal reality may be reached. Such a

stratification was presupposed in a "realistic" model of meaning in Wildgen (1994) and I will come back to in section 3.

c) In Artificial Intelligence (AI) and Natural Language Processing (NLP), which exploited the possibilities of the digital computer as a system of knowledge representation, another strategy has been followed. First, rather ad hoc ontologies abstracted from one language (mainly English) were devised to build up an architecture of contents.[4] As more knowledge domains and different languages were considered, a theoretical discussion was enhanced in search for general/optimal ontologies. Thus, Bateman (1992) distinguishes three types of ontologies:

   - (non-linguistic) conceptual ontologies based on common sense (whatever this may be).

    Scientifically this ontology could be elaborated in psychology or sociology.

   - Linguistic ontologies, based on the lexicogrammars of natural languages.

   - Interface ontologies which consider linguistic information to be just a subset of conceptual information.

In Hartmann's ontology, the "Realsphäre" has a stratum called "Geist" and is separated from "Seele". In the realm of "cognitive semantics" (since the 1980th), it seemed as if every thing was reduced to the brain (i.e., to individual cognition) and that further categorisations could only subdivide the mental. A typical example is the model of "mental maps" by Fauconnier (1984) and of "Blending" by Fauconnier and Turner (2000). Fauconnier distinguishes different domains to which "mental spaces" belong and reconstructs them on the basis of information contained in linguistic expressions. mental spaces are connected to discourse (in reality) through pragmatic connectors (cf. Fauconnier, 1984: 32). In "blending" different levels of mental spaces interact in a lattice-like structure. Two mental spaces from different domains (e.g., language and picture) are linked by a generalised mental space which establishes their comparability; this space is called "generic space". If two mental spaces are blended, the result (the blend) inherits some of the features of both (enhanced by the generic space) and may create new features by the emergence of blending-effects.

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[4] In lexicography content based dictionaries had already devised such ad hoc ontologies which depend heavily on the decisions of lexicographers in a national tradition (cf. for German Wehrle-Eggers, and Dowseiff).

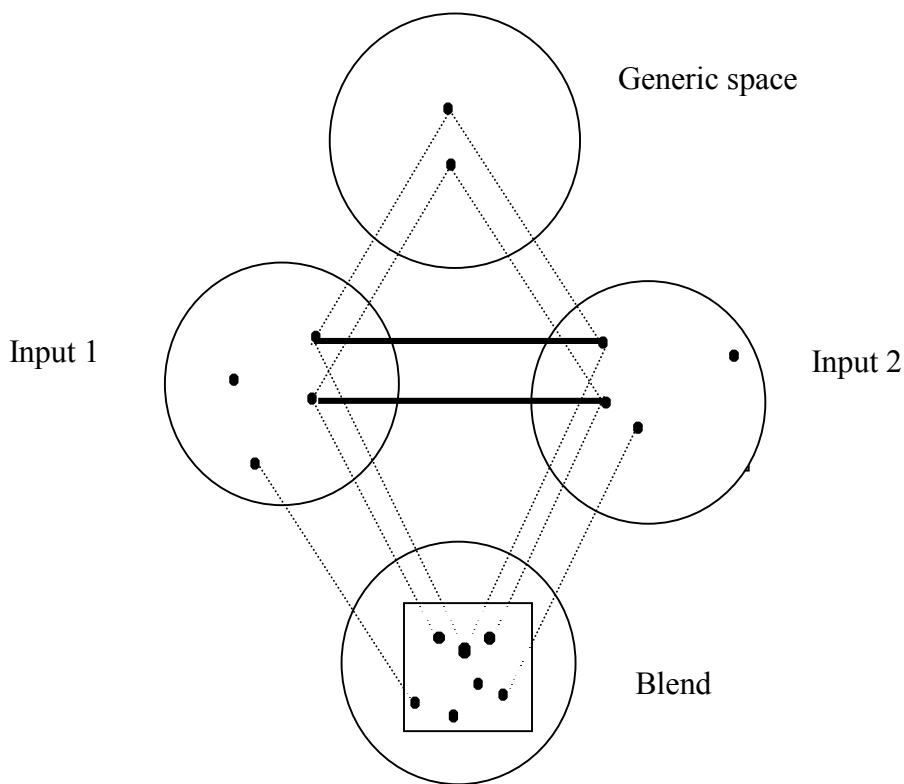The basic configuration of four spaces and five mapping relations is shown in Figure 2 (cf. Fauconnier 1999).

Figure 2: Basic blending-structure.

The spaces belong ontologically to the mental ("Seele" in Hartmann's terminology), but methodologically insofar as they are inferred from linguistic usage to the symbolic-collective ("Geist" in Hartmann's terminology). The generic space may in general cases come near to logical or epistemological categories and thus intersect with the "Idealsphäre" in Hartmann, whereas the blends, if they are innovative, create spaces beyond the "real". But what reality do all these spaces have? From a linguistic point of view, Fauconnier argues that every reference pertains to mental entities, which may be separated as belonging to different domains between which mappings and metaphors operate. This may be true at the level of discourse, where the speaker/hearer and their situation are the only anchoring domains which count. In the semantics of words and sentences a different, more basic, ontological classification can be inferred, which recovers the intuitions of philosophical ontology in the sense of Hartmann. Moreover, and this corresponds to Hartmann's basic goal, our scientific endeavour has an asymptotic tendency to categorise different strata of the real world adequately (even if this is prima facie less important in everyday discourse). Therefore, the possibility of a proper ontological grounding of *scientific* language is rather a regulatory principle than a linguistic reality.

Together these proposals show that the empirical and intuitive evidence which makes a specific ontology plausible has different sources:

- common sense or every-day realism,

- psychological and sociological explanations of common sense,

- languages as basic inventories of ontological assumptions and categorizations,

- results of the natural sciences which go systematically beyond common sense realism,

- coherence criteria of any basic system of assumptions and formal architectures of such systems (ideally in a mathematical format).

In the following section I shall propose a set of principles for a stratified ontology which uses catastrophe theory as formal architecture, which integrates results of physical dynamics, cognitive schematizations and basic sentence patterns. The fact that catastrophe theory is a generalization over basic insights into the stability and dynamics of systems in evolution (mainly in the domain of natural sciences) is not further elaborated (cf. Wildgen, 1982, Petitot, 1992, Wildgen, 1994, 1999). The ontology I propose has been developed in the context of research in cognitive semantics (cf. Wildgen, 1994: chapter 5) and is presented here in a slightly modified version.

3 PROPOSAL FOR A SEMANTIC STRATIFICATION BASED ON CATASTROPHE THEORY

The strata I will propose are ontological only in a derived sense. The semantics of natural languages imply an ontological hierarchy by the types of verbs and the semantic roles (valence patterns) these select. As we start from verbs and basic sentences which have these verbs at their center, the stratification is not a static but a dynamic one. It concerns "gestalts", relations, which secondarily ask for fillers, arguments, valence governed noun phrases or in a more general fashion for semantic roles and deep cases (cf. Wildgen, 1985: chapter 2 for a description of basic issues in the semantics of "deep" cases). By the choice of this procedure in the reconstruction of an ontological stratification we adopt the perspective of ecological realism and not the constructivist perspective of Carnap. The procedure seems to be compatible with Hartmann's intuitions of realism, but it goes beyond the stratification he has proposed. Therefore the systematic development shown in the following sections is not meant as a reconstruction of Hartmann's "Kategorialanalyse"; it can easily be associated with the program of morpho-dynamics proposed by René Thom and elaborated in Wildgen (1982) and later in Petitot-Cocorda (1992) and Wildgen (1994).

A first semantic principle stratifies the domains of interpretation. This principle is the basis of the semantic characterization of verbs in Wildgen (1994: Chapter 3 and 9).

Semantic principle of stratified domains of interpretation

Four major stratified domains can be distinguished: 1. locomotion in space and 2. external action/interaction, 3. internal action, 4. change in a quality space which are further subdivided in the Table 3 *to* Table 6.

Locomotion in space depends basically on physical laws (gravitation, dynamics of simple and double pendulums) and thus refers to Hartmann's category "matter" and inorganic laws (cf. Table 1 and Figure 1). The psychophysics of bodily locomotion involve a biological system, the body, which reduces the degrees of freedom of double-pendulums, introduces barriers and filters and thus selects specific motor-program (stratum: life), which are controlled by brain-centres (stratum: soul). Moreover, the modes of locomotion are learned (this involves socialization) and have individual features, which allow the identification of individuals (these features presuppose the stratum called "Geist"). Domain (1) covers *and* separates *all* strata of Hartmann, but the most prominent in terms of dynamics is the stratum of physical laws of motion.

The domain (2) of external action/interaction is complex insofar the manipulated object is typically governed by physical laws (gravitation, solidity), the action is, however, dominated by intentional control, purpose, needs, functions, etc. The centre of this domain is, therefore, the stratum of life, where these biological functions are grounded.

The domain (3) of internal action has the objects on the strata: matter and life, as *contents* (as Hartmann pointed out correctly). Its basic stratum is the brain (and other cognitive subsystems) and it corresponds to the stratum: soul ("Seele") in Hartmann's ontology.

The domain (4) of qualia finally has the soul, the organs of categorical perception, memory, imagination, and creative invention as substratum, but it depends heavily on learning, socialization, and language. Its center is, therefore, the stratum "Geist" and all mappings (e.g., brain topologies) have a strong conventional character. Qualia are, as Peirce pointed out, basically signs.

Under this interpretation the stratification of domains which grounds the semantics of human language, is compatible with Hartmann's proposals. He just did not go far enough into the cognitive and linguistic realms and was fixed to an epistemology critically dependent on the natural science (i.e., on the kind of "Naturphilosophie" they contain implicitly).

1.	*Locomotion in space-time)*
1.1	*Interlocal* locomotion (outside the neighborhood relative to some landmark).
1.2	Locomotion in the neighborhood of the system and its periphery, e.g., the movement of the limbs relative to a body; this type is called *local*.

Table 3:   Subdivisions of the first domain.

The same type of process may have a richer dynamical context and lead to action and interaction. As the perspective changes from one agent, to configurations of agents and objects/other agents, one may assume a further domain (or continuation of the first one with higher complexity).

2.	*Action and interaction (the process in an action or interaction scenario)*
2.1	External (physical, chemical, biological) action of an agent on an object
2.2	Action on another (secondary) agent.
2.3	Interaction between agents and means for the coordination of the interaction (a medium of communication).

Table 4:   Subdivisions of the second domain.

Action and interaction stand ontologically between physical locomotion (1), which governs parts of them, and internal (intentional) processes (3) which direct the action. The effect is often a change of quality (4). These processes are typically mixed, i.e., the different roles in an action/interaction scenario operate on different strata.

3.	*Internal action/interaction (with internalized objects and targets)*
3.1	Perceptual action (in the sensory system).
3.2	Mental action. This process is at least partially self-referential (in the brain).

Table 5:   Subdivisions of the third domain.

In domain 3 the processes are strictly internal within a body or a cognitive system; we cannot observe them directly in other people and cannot refer to them objectively. These processes have, however, perceivable traces (in the behavior of the individual) and we can linguistically label such a process and tell the event to our audience. The processes of domain 3 also have another peculiar property. They are the basis of a modality scale. The subdivision into the domains 1, 2, 3 hides the transitions which are rather smooth. Thus 2.3 is very close to 3.1

since the communicative act contains the aspect of perceiving a sign and of emitting one; so it is perceptual (3.1) and external (2.3) at the same time.

4.	*Change in a quality space*
4.1	Change on one categorical, mainly bipolar scale (in one dimension of the space of qualities).
4.2	Change in the phase-space of a dynamical system (from one phase to the other).
4.3	Change on a quantitative scale (at the ordinal, interval or metrical level of measurement).

Table 6:   Subdivisions of the fourth domain.

The change can be monovalent (the quality appears), bivalent (it changes to the other pole of the scale), or trivalent (with an intermediate phase on the quality scale).

In Wildgen (1994: chapter 3) schemata for locomotion, action and interaction were constructed as configurations which underlie the semantics of verbs and their valence. If we apply principle 1, these schemata can be interpreted in a different way, depending on the stratum, i.e., in a body-centered space-time (domain 1), in a space of action/interaction (domain 2), in a mental space (domain 3) or in a quality space (domain 4). The mathematical parameters contained in the schematization are interpreted by the dimensions of these spaces in the same way as mathematical models are interpreted differently for specific "real" systems in physics or chemistry. In this sense the domains introduced in principle 1 flesh out the formal schemata, they define the phenomenological foundation of the schemata and ensure that they are more than a mathematical construct on the one hand, or as an abstract level of a purely linguistic categorization on the other.

For every domain we may distinguish *maximum* schemata and *partial* schemata. The *bordering* or *abutment* relation between elementary catastrophes, whereby catastrophes lower down the hierarchy appear locally within higher ones, provides the formal basis for a general principle which relates the maximum schema to a partial one (see Wildgen, 1982: 93-97). This principle is called the "principle of dynamic inclusion" and will be applied in the following section.

Semantic principle of dynamic inclusion

A maximum schema (in a specific domain, cf. principle 1) contains topologically partial schemata which are simpler (have a smaller number of attractors) and are constituents of the maximum schema.

As a corollary we can state that if a non-maximum schema appears in a certain domain further (partial) schemata may be inferred and used in the organization and interpretation of larger utterances and texts. Only the maximum schemata will be enumerated in order to illustrate the dependence between domains and schemata.

4 A BASIC SET OF SEMANTIC ROLES

As a consequence of the first semantic principle we get different types of simple process-scenarios in every domain. These process-scenarios define a set of semantic roles for every domain. Within my framework, semantic roles are not purely linguistic labels, since they can be interpreted in terms of a cognitive theory of language. Thus their relation to surface phenomena like prepositions, morphological cases and word-order is less immediate than in a case-grammar of the type proposed by Fillmore (1968) and further elaborated in Fillmore (1977). Formally, my semantic roles are considered as variables which receive different interpretations in every domain. The invariant is not a syntactic or a semantic feature but the topological configuration of which a semantic role is a partial domain.

Although I use traditional labels, the content of these labels is not given by everyday use or by the usage in recent traditions. I systematically depart from case-theory insofar as my primary criterion is that of dynamic configuration. The possible dynamic configurations are nested and hierarchically structured (cf. principle 2). I distinguish:

- primary agents (they are the foundation of the process and do not disappear in the process): **A, P**;
- secondary agents (they appear and disappear in the process): **I, B**.

In my terminology Source-Goal are "allo-cases" since they interpret the configuration of two opposed poles in the domain of spatial locomotion. The "casemes" defined by the configurational criterion are called:

- **A** (Agent) - **P** (Patient) (primary roles)
- **I** (Intermediary) - **B** (Binding force) (secondary roles).

The label **I** summarizes a plurality of forces which are linearly intermediate between **A** and **P**. Depending on the domain of interpretation, **I** can be a path (interlocal locomotion), a metastable phase on a quality scale (quality space), an instrument (action space) or an object (change of possession).

The role **B** (binding force) has a rather variable realization. Configurationally it is an intermediary force parallel to the primary sequence **A-I-P**. It therefore calls for a second dimension in state space (cf. Wildgen, 1982: 85-92). It can be parallel to **A** (a helper of the

agent), to **P** (a beneficiary of the event) and to **I** (a secondary instrument, a medium of exchange).[5]

4.1 The domain: locomotion in space-time

Foreground and background must be distinguished (Langacker, 1987, calls these traditional terms 'trajectory' and 'landmark'). The background (landmark) is typically a domain in space-time; syntactically it is a prepositional or adverbial phrase and does not contribute to the thematic grid (the configuration of semantic roles).

Locomotion may be simple (linear) or include the transition through a frontier or even several, linearly arranged frontiers (on a path). The maximum configuration is one with the three roles: **A** (agent), **P** (patient), **I** (intermediary force). A possible elaboration contains one or more domains on the path through which the intermediary force goes when it comes from the source and before it reaches the goal. The maximum configuration has three roles, as Figure **3** shows. Partial configurations have two or just one role (attractor).
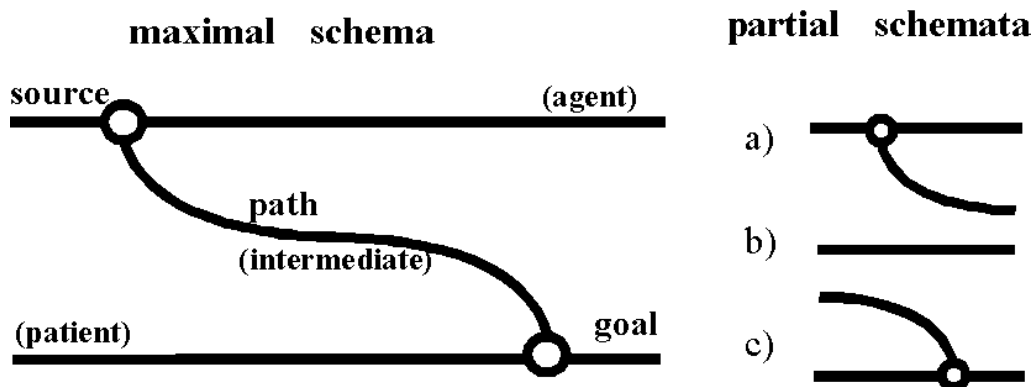

Figure 3:   The maximal schema of locomotion and partial schemata.

4.2 The domain: action and interaction

The maximum configuration is the schema of transfer (or of instrumental action which is the symmetric variant of it). Figure 3 shows the two schemata.

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[5]   A mathematically explicit analysis is given in Wildgen (1985: 208-212). The compacted elliptical umbilic has a two-dimensional behaviour-space and consecutively shows (along a linear path through the bifurcation set) the configurations: (**A, B, I**), (**B, I, P**). The attractor **B** disappears and **I** (object) is caught by **P**. The underlying schema is that of giving: (**A, I, P**).

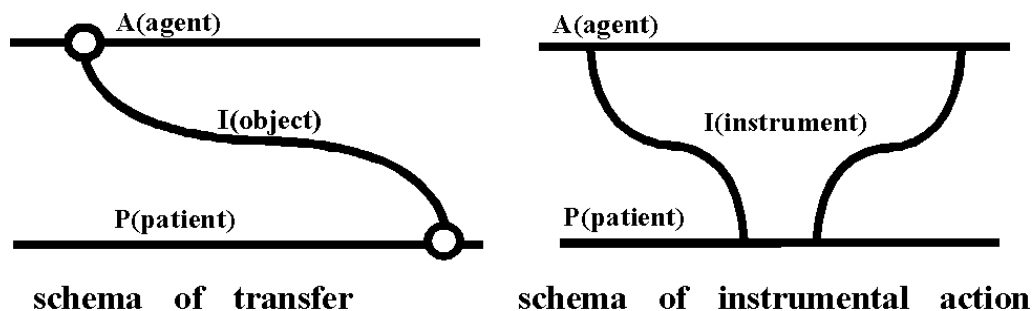schema   of   transfer   schema   of   instrumental   action

Figure 4: The maximal schemata of action and interaction.

The two variants have the same thematic grid (**A-I-P**). If principle 2 is applied implicit relations between the two scenarios and their thematic grid can be established.

Agent (**A**)(source)	Intermediary (**I**) Patient (**P**)(goal):	**A-I-P**
Agent (**A**)	Patient (**P**) (reduction of the secondary role **I**):	**A, P**
Agent (**A**)	Object / Instrument (**I**) (reduction of the primary role **P**):	**A, I**
Agent (**A**)	(minimal schema)	**A**

Table 7: The maximal schema and the levels of reduction.

In Figure 5 the elaborated schema which refers to a two-dimensional behaviour space is schematically represented.
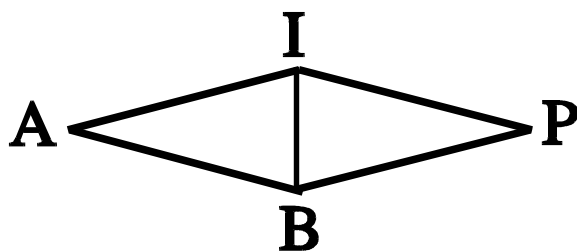

Figure 5: The elaborated schema (two-dimensional behavior space).

The fourth participant is called the binding force and it can be interpreted as a helper (i.e., a secondary agent in the tradition of narratology) or a beneficiary (a secondary patient). The four-valent scenario can be fully realized in the scenario of instrumental sending:

Example:

(i) **A**lbert (A: source) sends **I**mela (I: secondary agent) with **B**ritish Airways (B: helper) to **P**aris (P: goal)

The intermediary force can also be an object exchanged, or a primary instrument.

Examples:

(ii) Andrea (A) sends a letter (I) to her friend (P) by airmail (B).

(iii)   Annabel (A) gives an interview (I) to the press (P) by telephone (B).

(iv) Anne (A) propels the arrow (I) towards the tree (P) with a bow (B).

The further elaboration is characterized by a completion of the basic schema to a symmetrical configuration. In this completion the two intermediate roles may be split so that the values of the intermediate roles become different. This process is typical of possessive interaction (see table 2 above) where the object bought/sold and its equivalent, the money, fill two symmetrical, although different roles in the schema. The basic configuration is that of giving, completed towards a mutual gift.

As in the previous case an intermediate secondary force (e.g., a transmitter) may be introduced. In many realizations such as sentences, partial schemata are preferred, i.e., some other part of the schema is left unrealized. Thus in the following sentences we find a reduced realization of the basic schema:

(v)   My mother bought me a book.

(vi)   Charles bought a bicycle from his friend for $ 50.

In (v) the source (**A**) is not mentioned but the buyer (the binding force **B**: my mother), the object (**I**) and the Patient (**P**: me) are realized; in (vi) the Source (**A**: from his friend), the object (**I₁**), the price (the equivalent to the object) I_2 and the beneficiary, who is identical with the buyer ("for himself", **B** = **P**), are mentioned.

4.3 The domain: communicative and perceptual action

The configuration is similar to those already discussed. We can distinguish between *emissive* actions, where perceivable events are produced and *receptive* actions, where such events are received. If both partial schemata combine we have a transfer of perceivable units, signal transmission; if this transmission is mutual and reciprocal we have sign communication. If a symbolic instrument, a system of conventional signs, is put to work, a binding force is added. Language as a system is such a symbolic instrument. The roles which are defined by their place in the configuration have a somewhat different content. Figure 6 shows the basic configuration.
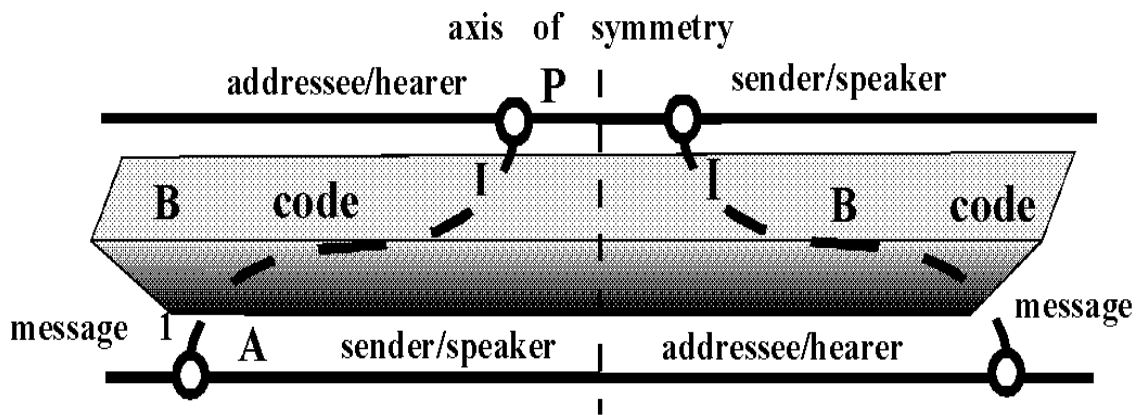
Figure 6: The basic schema of communicative action.

If we take a closer look at the dynamics of the event, we notice important differences between communicative action (domain 2.3) and the basic domains 2.2 (change of possession) and 1 (physical action):

- The message is not lost by the sender if he emits it. Rather, he sends a duplicate; in a similar vein the receiver creates an analogous message, using the information he receives and mental knowledge.
- The intermediary role B (the binding force, the code) is a necessary constituent for the transfer which could not take place without it. Furthermore this force is very rich and complicated. Whereas the Agent and the Patient are individuals, the language system has a social, supra-individual and, therefore, abstract nature.

In perception, the object received can be either a sign or simply a percept (some natural input to the sensory organs). The sensory inputs which are continually entering our sensory organs are the background of sign-reception. At an intermediate level our attention is focused on a specific percept; we see, hear, smell something specific. The topological scenario is that of capture.

These basic deviations from external processes become even more prominent if we analyze what is going on in mental action.

4.4 The domain: mental action

The new phenomena at this stratum are:

- the semantic closure of the mind on itself, this strange feature was emphasized by Maturana (1980) and other theoreticians of the brain,
- the self-referential nature of mental processes,

- the overwhelming importance of cognitive contexts, i.e., of memory, knowledge, emotional disposition, attitudes, personality traits, etc.

These basic characteristics are schematically represented in a specific form of the maximum schema, which is given in Figure 7.
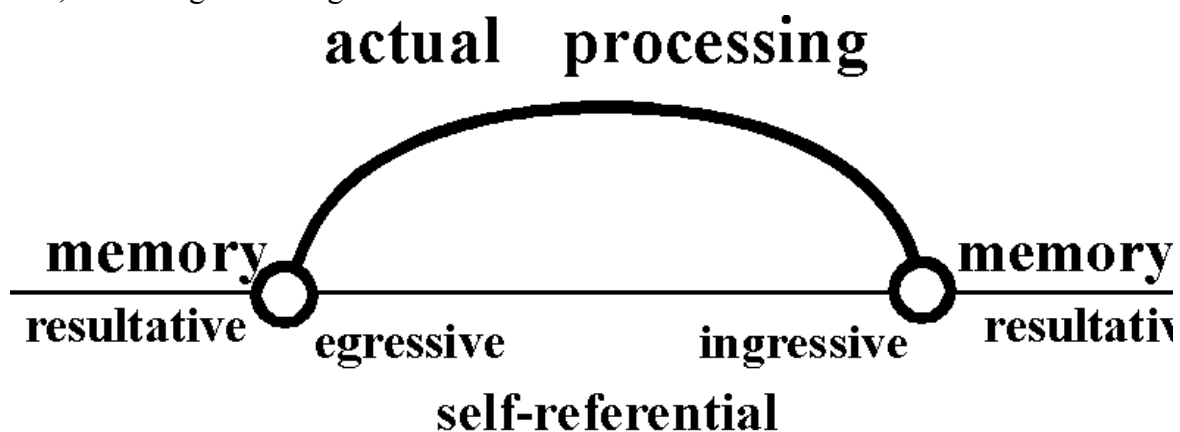

Figure 7: The basic schema. of mental action.

The different phases of the process are labeled:

- egressive (emission): the mind produces an idea, an emotion, an attitude,

- ingressive (reception): the mind receives, retains, stabilizes an idea, an emotion, an attitude,

- self-referentiality: the mind produces and receives (from itself) an idea, an emotion, an attitude.

The egressive and ingressive schemata are only partial pictures of self-referentiality which is more complete. The actual processes can become part of the permanent structure of the mind and parts of the permanent structure can in turn be actualized. This mode is called resultative. The pure form of the resultative phase is the stock of persistent ideas, emotions, etc. in the mind.

4.5 The domain: change in a quality space

The configurations are similar to those in Section 4.2, the difference being that partial schemata are more frequent and that the elaboration with a third (intermediate) quality are very rare. Parallel to the traditional distinction in mathematical linguistics (cf. Marcus, 1967: 4-20), we can introduce two pairs; A vs. non-A (privation of A) and A vs. CA (bimodal proportional opposition of A to its complement CA). In the first case we consider only a partial scenario

while the complementary state is left undetermined. In a proportional opposition both qualitative states are present; the change from one quality to the other is moved into the foreground.

1. Privation

   stop to be A (become non-A),

   begin to be A (stop to be non-A);

2. Proportional

   stop to be A (leave the domain A and become CA, i.e., change from A to CA),

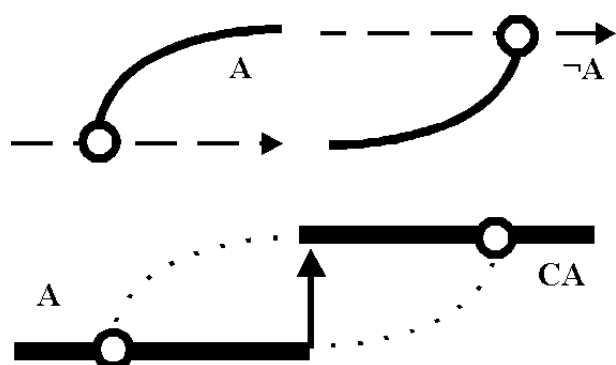   begin to be A (leave the domain CA and become A).

Figure 8: Basic processes in a quality space.

We can easily see that the first schema is a proper part of the second one. Thus the relation between the two falls under principle 2.

5 A NATURAL TOPOLOGY OF THE HUMAN MIND: SUMMARY

Humans and their minds are the center of a natural topology which organizes the domains introduced before. Table 8 shows the ordinal scale of domains, relative to the mind of Ego as it has been developed in the last sections.

soul ⇐ EGO		EGO matter/life (continuum) →world/object→ALTER					Geist ⇨society		
3.2	3.1	1.1	1.2	2.1	2.2	2.5	4.1	4.2	4.3
mental	perception	body motion	inter-motion	action on objects	action on another agent	inter-action between agents	categories	phases	scales

Table 8:   The scale of domains.

An event/change in the ecology of the speaker can be perceived as belonging to a specific domain, for instance to the basic domain of locomotion. In the utterance it can, however, be embedded in another domain, such as perception, imagination, remembering or it can be considered on behalf of some qualitative result etc. This means that the speaker (and with him the listener) can move on the scale shown in Table 8. The projection of "real" events onto such a scale will be called a "modality scale". Despite the introduction of this freedom from "real" events introduced by movements on the modality scale, the semantics are still "realistic" insofar as the transformations of events belonging to the ecology of the speaker are not independent from the bodily basis of meaning but are rooted in it and inherit their stability from these roots. We predict that in those cases where the "realistic" links are lost, the co-ordination between speaker and listener, or even the stability of "inner" language in the speaker himself, is also lost and language degenerates (it becomes noise).

If we have a single event (at a center level on the modality scale), e.g., a process in space (interlocal or local), this event may reappear in the text in the form of an infinitive construction or a subordinated clause. If the simple event is: "Jim fell from the tree" (stratum 1.1). This sentence may appear as subordinated to a sentential frame with the following verbs.

I (John) saw Jim falling from the tree. (1)   (stratum 3.1)

I (John) saw that Jim fell from the tree. (2a)   (strata 3.1/3.2)

I noticed that Jim fell from the tree. (2b)   (strata 3.1/3.2)

I know that Jim fell from the tree. (3a)   (stratum 3.2)

I believe that Jim fell from the tree. (3b)   (stratum 3.2)

Jim's falling from the tree.   (stratum 4.2)

If the major distinctions made by Barwise and Perry (1984) are interpreted as categorical posi-tions (we presume that a relevant inter-language variation exists in this field) we can establish a linear scale with four positions as shown in **Fehler! Verweisquelle konnte nicht gefunden werden.**.

The speaker not only perceives, recalls and knows (believes) events and actions; but he may also imagine further events/actions, and consider possible outcomes of current events/actions. Parallel to and ahead of current events, alternative possibilities may be considered and possible outcomes may be in the intentional domain of the speaker. This leads to further strata of imagined realities, fantasies, etc.

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