CHAPTER 2
A CRITICAL REVIEW OF SOME PROPOSALS FOR A SEMANTICS USING IMAGE- AND PROCESS-SCHEMATA♣

We shall discuss specific proposals in the framework of cognitive semantics and situation semantics (cf. the theoretical evaluation in Chapter 1, Sections 4.1 and 4.2). In the framework of cognitive semantics three subtypes of models can be distinguished:

♣ This a preprint version of chapter 2 in: Wildgen, Wolfgang, 1994. Process, Image, and Meaning. A Realistic Model of the Meanings of Sentences and Narrative Texts, Series: Pragmatics and Beyond, New Series, No. 31, Benjamins, Amsterdam (p. 29-43). For the bibliography see ibidem: 255-270.

a. The proposals made by Talmy since 1972 (unpublished dissertation). He introduced image-like representations of an informal type (diagrams, schematic pictures) for specific domains of grammar which lend themselves to a spatio-temporal analysis (local pronouns, spatial prepositions, verbs of motion). In more recent research he developed a "force-dynamic" representation of causatives and connectives like "because" and "despite".

b. Langacker (since 1979) proposed a more general pictorial representation for grammatical analysis and developed a very general, although informal, theory first called "space-grammar" and later "cognitive grammar" (see Langacker, 1987, 1991). Within this framework he proposed pictorial representations for verbs and for the constituent structure of sentences.

c. Lakoff gives an image-like analysis of the preposition "over" within a framework called "cognitive semantics". He refers to Langacker (1987) as a more general account, for the analysis of "over" he proposes a set of image-like descriptions (cf. also Brugman, 1989).

1 Talmy's imaging systems and his "force dynamics"

Talmy made use of some pictorial representations in his analysis of the verbs of motion and especially in the analysis of the prepositions that occur in sentences like the following (cf. Talmy 1975: 201-205):

– The ball sailed *past* his head.
– The ball rolled *across* the border.
– The ball sailed *through* the window-pane.
– The ball sailed *through* the hoop.
– He walked *along* a row of houses.
– He walked *along* the path.

– He crawled *up inside* the chimney.
– He ran *around* the house.
– He walked *across* the field.
– He ran *around* the house.

The technique of description follows the methodology of generative semantics using "deep" predicates (predicate constants) and a series of transformations from deep structure to surface structure, and pictures have a "merely suggestive" character. (Some pictures appear on pp. 201-204, the formulaic description prevails.)

Beginning with his article "How Language Structures Space" (1983) in an interdisciplinary volume on "Spatial Orientation" Talmy introduced the concept of "imaging systems". He first distinguished four systems:

a. "abstract geometric characterizations of objects and their relationships to each other within different reference frames." (ibid.: 253)
b. "perspective point - ... the point within a scene at which one conceptually places ones "mental eyes" to look out over the rest of the scene ..." (ibid.: 255)
c. "the particular" distribution of attention to be given to a referent scene from an indicated perspective point." (ibid.: 256)
d. "force dynamics, i.e. the ways that objects are conceived to interrelate with respect to the exertion of and the resistance to force, the overcoming of such resistance, barriers to the exertion of force and the removal of such barriers, etc." (ibid.: 257)

In Talmy (1987) the first system is called "structural schematization" and although space and time are mentioned besides "some other conceptual dimension", the reference to geometry is lacking (ibid.: 28). In more recent papers (1991, 1993) the fourth system is lacking and the first system is called "configurational structure". Thus the original impetus towards an interdisciplinary framework, which would relate spatial perception and language, is reduced and the processual aspects emphasized in Talmy's "force dynamics" disappear.[1] Nevertheless, there is still a major theoretical difference

between Talmy's and Langacker's work, insofar as Talmy's semantics systematically considers parallels between spatial perception and basic linguistic schematizations. His descriptive analyses can be considered as empirical (although intuitive) work which samples major aspects of natural language in order to show a plausible dependence on perceptual processes in our everyday experience (experimental results of psychology, results of neuropsychology or neuroinformatics are not considered). A theoretical (or formal) framework in which both semantic and perceptual facts could be integrated is not even programmatically postulated. As the processual aspects are central for the following chapters I shall focus on Talmy's treatment of force dynamics in his article "Force Dynamics in Language and Cognition" (1988).

Talmy introduces the following basic concepts:

- exertion of force,
- resistance to such exertion,
- overcoming of such resistance,
- blockage of a force,
- removal of such blockage.

Talmy (1988: 5) considers the following sentences:

a. The ball kept rolling because of the wind blowing on it.

b. The log kept lying on the incline because of the ridge there.

c. The ball kept rolling despite the stiff grass.

d. The shed kept standing despite the gale wind blowing against it.

For the sentences (a) and (b) which have "because" as a conjunction the intrinsic force tendency is opposed to the result of the force interaction, i.e. there is a *change* in the force constellation. In Talmy's imaginistic representation this opposition shows up as a contrast between a vector (>) of change and a zero vector (o).[2]

a. The ball kept rolling because of the wind blowing on it.

intrinsic force tendency: towards rest (o)

--->--- result of the force interaction: action (-->--)

b. The log kept lying on the incline because of the ridge there.

intrinsic force tendency: towards action (>)

----o---- result of the force interaction: rest ---o---

As "laterality" (in the sense of Talmy) is irrelevant, mirror-image diagrams represent the same FD pattern (FD = force dynamics) (ibid.: 4); the invariant feature (responsible for the invariant conjunction: "because") is depolarization, either from:

---0 ---/--->--- (rest -> action)

or

--->---/---o--- (action -> rest)

In the case of the conjunction "despite", the opposite is the case:

c. The ball kept rolling despite the stiff grass.

intrinsic force tendency: towards action (>)

---->----- result of force interaction: action (--->---)

d. The shed kept standing despite the gale wind blowing against it

intrinsic force tendency: towards rest (o)

---o--- result of force interaction: rest (---o---)

The invariant responsible for the conjunction "despite" is the non-event, non-change. In this sense "despite" negates a default interpretation of "because".

The basic feature is a transition from *rest* to *action* or vice versa in the case of "because" and the negation of this change in the case of "despite".

Although Talmy repudiates a formal, geometrical or topological analysis (Lakoff would surely call it "objectivistic") his pictorial representations make use of mathematical notions in a naive way. Thus we can associate his symbols with different mathematical sub-disciplines.

+, -, > : algebra

circles, a rectangle, parts of a circle : geometry

-->--, --o-- : (vaguely related to) vector-calculus

--/-- : (vaguely related to) phase-transitions in dynamical systems theory

The quasi-formal symbols in Talmy's description come from algebra, geometry, topology and vector-calculus, but the mathematical properties of these concepts are neither exploited nor respected.

The interpretation of forces as protagonists and antagonists takes up an old tradition without acknowledging the sources. The opposition between protagonist and antagonist goes back to classifications of figures and characters in novels and dramas. In our century Propp (1928/58) proposed a basic classification containing the roles of the hero and his opponents. Beaugrande and Colby (1979) introduced the corresponding notion "protagonist" and "antagonist" into modern, computer-assisted textual analysis.

The problem with an analysis like Talmy's is its integration into existing (partially) formalized theories of grammar. It is not consistent, if on the one hand algebraic, generative formalisms (although not fully exploited) are taken for granted and, on the other, formal topological devices are not accepted. Either the whole grammar should be formulated in intuitive terms or every systematic piece of linguistic modelling should be further developed, with the aim of arriving at a formal account at least of the central parts of the grammar which is being proposed.

2 The image schemata proposed by George Lakoff

Beginning with his 1977 article "Linguistic Gestalts" Lakoff tried to go beyond the algebraic and logical models which dominated theoretical linguistics in the seventies. In "Linguistic Gestalts" (1977: 247) he states the programmatic concerns which fall under the traditional term "gestalt":

> "Thought, perception, emotions, cognitive processing, motor activity and language are all organized in terms of the same kinds of structures, which I am calling gestalts."

In his work "Women, Fire and Dangerous Things" (1987) Lakoff reviews a series of positions in formal semantics (called "objectivistic semantics") and develops a programme of ICM (internal cognitive models). His philosophical

position is akin to Putman's internal realism, i.e. to a kind of amalgam between constructivism (internal) and a shallow notion of realism (minimal assumptions about external conditions). (cf. Section 4.2 in Chapter 1)

Lakoff (1987) introduces "kinaesthetic image schemes" as a central term and elaborates this idea in a chapter where he describes the different (contextual) senses of "over"[3]. As this is the only extensive use of imaginistic schemata I found in his work, it can be said to stand for Lakoff's understanding of an imaginistic language inside cognitive grammar. I selected several of the 26 figures which illustrate different meanings of the preposition "over" and reorganized the pictures into three major types shown in Figure 2.1. The abbreviations TR and LM stand for "trajector" and "landmark", two terms which Langacker (1987) proposed for the traditional labels foreground = trajector and background = landmark.

If we consider the different pictorial representations of "over" (cf. Lakoff 1987: 419-434), the following types of situations can be distinguished (the numbers refer to the figures in Lakoff, 1987):

a.
```
          TR
----l---------o-------l--->  (1,2,3,4,5,6,7)     verbs: fly, drive, walk, climb
  LM.............LM
```
example: The bird (TR) flew over the yard (LM)

b.
```
                TR
----|---------------->|--o-     (10, 11,)      verbs: live, be
   LM............LM
```
example: Sam (TR) lives over the hill (LM)

c.
```
  TR
  ------                    (13, 14)       verbs: hang, stretch
  LM
```
example: The painting (TR) hangs over the fireplace (LM)

Figure 2.1 *A combined diagram for three classes of meanings of "over"*

The differences between a, b and c are mainly due to the type of verb:

a. verbs of motion: fly, drive, walk, climb,
b. verbs of local position (relative to a prior motion): live, be,
c. verbs of local position (without prior motion): hang, stretch.

The second and third types are either implicitly dynamic in the sense that in order to reach their location one has to travel "over the hill, over the bridge", or they are purely locational (hang, stretch), in which case the focus is on the basic notion of a relation in the vertical direction. Thus we may easily decompose the pictorial gestalts shown by Lakoff into a basic dynamic schema (a) and several (static) attributes (b, c):

a. transition in space,
b. a result indicating a perspective as in: live, be (cf. the "end point focus" in Lakoff's description),
c. a relation in the vertical dimension: A above B (in Lakoff's description).

This example shows that geometrical and dynamic "gestalts" may be decomposed and analyzed systematically.[4] In general, these image-like concepts in Lakoff's framework only have a heuristic value, and they could be fully replaced by a relational network which is more complete and more sophisticated. As schematic pictures have already played a heuristic role in the whole tradition of school-grammars, one cannot see how these proposals have anything to do with a new paradigm based on "kinaesthetic image schemes". It seems as if the "cognitive" parts of the theory were totally superfluous, they were added as a kind of fashionable decor to a traditional description.

3 Techniques of imaginistic representation by Langacker

The most extensive and complete proposals for spatial representations in grammar are put forward by Langacker (1987 and 1990). He directly considers the spatio-temporal pattern which may underlie sentences and tries to integrate the traditional constituent analysis into his imaginistic model. The following is

his analysis of the lexical item ENTER and the pictorial representation of the proposition: FIND-WOMAN- MAN (the man finds the woman). The constituent structure puts partial images into a temporal scenario so that a phrase-structure tree with imaginistic constituents can be derived.[5]

a. The representation of the verb ENTER in Figure 2.2, taken from Langacker (1987), shows two stages to his analysis. In the upper picture a non-minimal number of stages (snap-shots) of the process are considered. If the number 5, chosen by Langacker, was increased and approached infinity we would come near to a continuous process described by a differential equation. In the second picture only the minimal phases (n=3) are considered; in fact one could eliminate the intermediate picture and would arrive at the traditional notion of a starting-state and an end-state. Langacker's notation stops midway between a logical model (two states - one predicate) and a continuous model (an infinity of stages).

Figure 2.2 *Langacker's analysis of the verb ENTER*

b. In the space-representation of the proposition FIND-WOMAN-MAN, the picture for FIND resembles the picture for ENTER topologically, the main difference being the specific filling of the landmark by an entity. The constituent structure is interpreted as a hierarchy in the filling of the open slots (categories) in the pictorial representation of the verb FIND. Whereas in (a) we handled the spatial background of entering a house as the domain on which the process was defined, i.e. as a spatial context, the verb "find" is bivalent and we need two basic spaces for the motion of MAN and of WOMAN. In fact, Langacker's pictorial representation shows the analogy to the monovalent picture for ENTER; as WOMAN is on the base-line, it is the PATIENT of the process. The constituent MAN makes a transition from SEEKING-NOT FOUND to FOUND.

The new thing in this analysis is that pictures may be inserted into lexical positions (cf. the schemes for "find, "enter" and the pictures for "woman" and "man"). The only cognitive notion introduced is the very basic distinction between figure and ground taken from gestalt-psychology (the question of the cognitive mechanism underlying this very impressionistic notion is not raised). In Langacker (1990: 12-15) the topic of grammar as image is further discussed. He takes a rather weak position which distinguishes his endeavour from ours. He says:

> "The symbolic resources of a language generally provide an array of alternative images for describing a given scene, and we shift from one to another with great facility, often within the confines of a single sentence. The conventional imagery invoked for linguistic expression is a fleeting thing that neither defines nor constrains the contents of our thoughts".

As this citation shows images are not some stable, invariant background, on the contrary they are even more unstable and fluctuating than language itself. Therefore, image in the sense of Langacker is different from image as described in Chapter 1, Section 2 and from the schemata proposed in the Chapters 3 to 5.[6] The first consequence is that linguistics may help us to guess what these ‘images’ are, but these ‘images’ are unstable after-effects of meaning, and cannot help us in understanding meaning. The whole programme is beyond our critique if such a deeper understanding is not asked for (this strategy seems the one preferred by Langacker). Nevertheless, the programme is theoretically ambiguous. If images are only vague and fluctuating after-effects observed in the analysis of linguistic structures, how can we ever know anything specific about these volatile creatures? What are the empirical techniques which allow for the capturing of these phantoms? If we look at the large corpus of image analyses presented in Langacker (1987 and 1991) the answer is almost shocking: *The individual introspective insight of the linguist, supported by heuristic techniques taken from current linguistic models are the only empirical method used.*

Figure 2.3 *The constituent analysis of FIND-WOMAN-MAN in Langacker's analysis*

The fluctuating images correlated with grammatical structures have inherited the 'holy' character of intuitions about grammaticality, ambiguity and paraphrase in classical generative linguistics. We could, however, accept Langacker's proposals as a heuristic for seeking space- and time-related grammatical categorizations (or candidates for such categories) in the languages of the world. The enterprise would, therefore, continue the work begun by Sapir and Whorf and would be a purely taxonomic one. Langacker would probably agree that such a heuristic taxonomy can use any techniques of representation and that images have certain didactic advantages and can be added to traditional techniques which invented a list of labels for the designation of such categories. If these heuristic, taxonomic analyses are the only tasks, most of the theoretical claims (cf. Lakoff, 1987) should be abandoned and the whole enterprise would not be a specific contribution to cognitive science or to other disciplines.

4 Spatial domains and matrices (proposals by Langacker and Talmy)

Langacker's theory of (spatial) domains and semantic matrices is one field where he goes beyond pictorial descriptions of lexical items and tries to reach a more general level. Semantic domains and matrices are rooted in perceptual and motor space and are related to the concept of space elaborated in contemporary physics and psychophysics. This concept goes, however, beyond the simple (mostly three-dimensional), Euclidean and compact-coherent concept of space. I shall discuss the proposals in Langacker (1987, Chapter 4) and Talmy (1983) with respect to the basic distinctions and the corresponding proposals for linguistic description.

The *basic domains* are the Euclidean spaces R^1, R^2, R^3 for locations and R^1 for time[7]. Together they lead to a four-dimensional concept of space, at most, (usually reduced to three dimensions in actual use). These basic domains have a global evolutionary explanation and are inherent in our general motor-sensory-system[8].

Beyond this global domain, more specific domains evolve from our actual experience.

- visual domain (2-3 dimensions of spatial vision, colour, texture, etc.),
- auditive domain, gustatory domain, olfactory domain, tactile domain, kinaesthetic domain.

Abstract domains are built on basic domains. Thus the shape of BODY can be characterized by the space domain that the body fills. But we can go further by considering the partinomy of BODY which is a hierarchy, parts of which are:

BODY ---> HAND ---> FINGER ---> KNUCKLE[9]

These content structures pertain to an *abstract domain*.

Domains have a typical number of dimensions, a topology, sometimes a metrical structure. Most domains have a rather low number of dimensions.

- space - time (maximally 4/ usually 3)
- colour (usually 3/ sometimes 4)
- natural numbers (1 dimension)
- kinship terms (usually 2 or 3 dimensions)

The scaling of the dimension can be continuous or discrete, topological or metrical, etc. Compact domains of low dimensionality fit together systematically (as in the metaphor of a mosaic, a field, an array of pigeon-holes in traditional lexicology). In this case the categories delimited in the domain are:

- contiguous (common boundaries),
- nearly exhaustive (few gaps),
- mutually exclusive,
- of equal size (cf. Talmy, 1983: 276).

These maximally coherent and economic domains appear in central, well organized and highly functional areas of linguistic cognition. However, in many other cases the background of meaning is an open list of dimensions with a poor exploitation of the space defined by them.

Langacker (1987:154) mentions the concept [BANANA] for which he postulates:

- a specification for shape in the spatial (and/or visual) domain;
- a colour configuration involving the co-ordination of colour-space with this domain;
- a location in the domain of taste/smell sensations;
- the knowledge that bananas are eaten, that they grow on branches, on trees, that they come from tropical areas, etc. (ibid.).

The fact that this list is open-ended means that the dimensionality of space is not well defined; in general the dimensionality is very high for a specific meaning of the word. Langacker proposes to call these high-dimensional and rather poorly organized spaces: *matrices*.

It seems important to distinguish on the one hand the *domains*, for which the coherent and systematically exploited ambient space R^3 is a theoretical, ideal structure, and which is "metaphorically" transposed to some other domain (namely to other perceptual and to a few very basic abstract domains) and on the other hand the *matrix* with its large and highly variable dimensionality. It has a poor topology (mostly no strong metrical structure).

Nevertheless, the distinction between domains and matrices has only heuristic value. If we take the lexicon of adjectives (ignoring dimensional adjectives) it is clear that they pertain more to semantic matrices than to domains. However, it was just this field of lexical items which allowed Osgood to establish a three-dimensional semantic space. As the adjectival meanings can be organized by a three-dimensional space E-P-A (Evaluation, Potency, Activity), they formally belong to a domain although the dimensions of the three-dimensional space are not spatial. The underlying distinction is therefore more an ontological one.

- domains: refer to space-time dimensions (referential/external)
- matrices: refer to connotational dimensions (intentional/internal)

In both cases we find items matching the basic three-dimensional character and items which at first sight are much more complex, they belong to the fringes, the fuzzy border. They may be compared to the chaotic outskirts of a dimensionally ordered core-domain (cf. Section 2 of Chapter 4 for chaos theory and its application to semantics).

5 A criticism of imaginistic representations in the style of Talmy, Lakoff and Langacker

A short overview of the types of imaginistic representations proposed by Talmy, Lakoff and Langacker shows:

- The imaginistic language used is neither systematic nor conclusive and rests only on an intuitive perception of a possible relation between pictorial schemata and linguistic expressions.
- Those imaginistic representations which are intuitively plausible cover only a small sub-field of the lexicon and of basic syntax.
- There is no theoretical account of how the images may be constructed; they are mere illustrations based on a set of vaguely defined conventions.
- The enormous possibilities of space-orientated modelling using geometry, topology, differential topology and other mathematical models, which have dealt with similar conceptual problems (partially since antiquity) are systematically ignored.
- The epistemological claim that grammar must be independent of mathematical techniques is incompatible with the integration of standard techniques used in generative grammar, as these are based on algebraic concepts and not on "natural" categories.

In order to make the programme of a "cognitive grammar" which Lakoff and Langacker have proposed convincing, a new generation of precise and

systematic tools must be developed which allow for theoretical elaboration and an empirical concretization of the programme.

In this book the programme of an integration of linguistic research into current developments in the cognitive sciences (basically theoretical psychology and biology) is taken seriously. However, this integration cannot be achieved if the older structuralist programme which motivated the splendid isolation of linguistic theory from neighbouring disciplines is not given up in practice. This means that the structuralist and more specifically the generative paradigm must be radically modified. It is clear that after a century in which structuralism has become the self-evident basis of all linguistic theorizing this radical decision is difficult to put into practice.

6 The representation of motion verbs in situation semantics

The framework for semantics developed by Barwise and Perry (1984) has two central interests. First it replaces the value of possible worlds by pieces of the world called "situations", second it puts forward a theory of propositional attitudes. I shall make use of their results on attitudes in Section 3 of Chapter 5. In the present context I want to review the treatment of motion verbs and of the constructions in which they are used. I shall consider one sentence with the motion verb "run" of which Colban (1987) gave an explicit analysis in terms of situation semantics:

Peter ran to the school

Colban (1987: 153f) first gives a fragment of "English containing PP's", (ibid.: 135-152) in the style of Lexical Functional Grammar. The sentence above is characterized by a constituent structure in the shape of a constituent tree (cf. Figure 2.4), and a situation schema in the shape of attribute-value-logic. As the machinery of situation semantics cannot be introduced here, the content of the situation schema will be informally reported. Figure 2.4 shows the constituent structure of the sentence above.

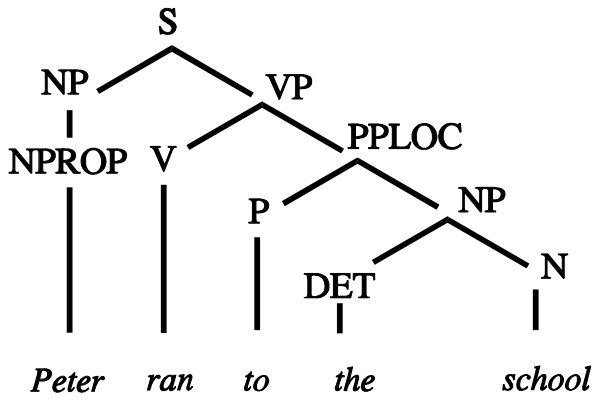

Figure 2.4 *The constituent structure of "Peter ran to the school" (PPLOC = locative prepositional phrase; NPROP = proper name; P = preposition; DET = determinant)*

The prepositional phrase may be omitted, it is an adjunct (otherwise it would belong to the category PPOBL - obligatory prepositional phrase). As it is directly subordinated to the VP, it is treated as part of the relational structure of "run".

The situation schema contains four relations (ibid.: 141):

1. The relation "run" with the argument positions: Peter (ARG.1) and a location LOC, in which the conditions specify two further relations:
2. The temporal relation "<" stands for the past tense in "ran", i.e. the "running of Peter" occurs before the time of utterance.
3. The spatial relation "to" which takes as arguments the "running of Peter" and a complex second argument in which a further condition introduces the fourth relation:
4. The relation "school" which has Peter as its only argument, i.e. Peter is at the school.

The semantic interpretation of the situation schema introduces the utterance situation and the described situation, a temporal relation "<" (temporally precedes) and a curve in space-time that ends at the location of the individual called Peter at the location of the school.

After the application of all this machinery the interpretation of the sentence: "Peter ran to the school" can be described as a function of space (one dimension) and time. Figure 2.5 illustrates the result (cf. Colban, 1987: 154).

Figure 2.5 *Summary of the semantic analysis proposed by Colban (1987) for the sentence: "Peter ran to the school"*

If we "read" the analysis in Figure 2.5 we can distinguish:

a. the temporal relation, which presupposes a resultative event, i.e. it comes to a final point, and relates it to the time of utterance;
b. the kinematics of "Peter's running" which can be simplified to a one-dimensional representation, if we have two fixed points (the point of departure and the point of arrival). In this example the distance between both points is monotonically decreasing.

It is revealing that although some semantic theories like situation semantics have an underlying "realistic" programme, they rarely arrive at a topologico-dynamic generalization like Colban's one. Colban does not try similar generalizations for the more complicated sentences for which he gives constituent structures and (formulaic) situation schemata, i.e. for:

- The book was lying on the table.
- Peter laid the book on the table.
- Peter gave the book to Anne.
- Peter gave Anne the book.
- Peter sent a letter from Pluto to Anne.

If we were arguing in favour of formulaic descriptions, we could propose that it is possible to transform our topologico-dynamic notation into the formulaic description in the style of situation semantics (but then we would lose generality in terms of a *cognitive model*). In the next chapter I shall systematically build a topologico-dynamic model as a possible framework for

all the enterprises, the theoretical and formal inadequacies of which have been shown in the present chapter.

1 In Wildgen (1988) the following hierarchy of levels, inspired by ideas of Brentano (1911), is proposed: (a) real configurations; (b) intentional configurations; (c) real perspectivation; (d) intentional perspectivation.

2 The circles represent the Agonist, the complementary parts of a rectangle the Antagonist, + means the stronger entity, - the weaker entity (cf. bid: 4).

3 Lakoff refers to an MA thesis by Claudia Brugman from 1981, cf. Brugman (1989).

4 Lakoff himself creates a decomposition when he uses three basic schemata and several attributes like: EXTENDED, WITH CONTACT/WITHOUT CONTACT, VERTICAL, ONE-DIMENSIONAL, END POINT FOCUS, etc.

5 If we consider only the basic imaginistic representations proposed by Langacker, we can "translate" his pictorial language into the imaginistic language proposed in Chapter 7. One can imagine a vector representation of his grammatical analysis along this line of "translation". Langacker himself regards his pictures as a purely conventional means of expressing semantic content. They could be replaced by any other representations. Image orientated representations seem to be practical tools for small scale analyses in semantics.

6 The schemata proposed in Chapters 3 to 5 are not experienced subjectively, they are more a theoretical account of psychophysical invariants which are constitutive for the intermediate cognitive level called "imaginistic". For this reason they must be deduced from general dynamic and topological principles and cannot be "intuited". For the level of personal narrative we assume some kind of "imagined scenes" which could match with Langacker's images.

7 The set of *real* numbers (a continuum) is called R.

8 In the sense of Kant we could call them "transcendental", as they are a precondition to experience and obligatorily appear as underlying features of our cognitive system. This explains their rather abstract character.

9 Cf. also Langacker (1993:4).