Realistic semantics and the multistability of meaning*

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1. Meaning and imagination

The idea that the outer world sends pictures which enter our visual system and establish the link between our mind and the world stems from antiquity. For Descartes the process was an optical-nervous one. He conceived the activity of the nerves as a mechanical and pneumatic system where the nerves act like cords which open small channels. These openings reconstruct the shape of the external objects. Images and imagination are thus the classical field for the interaction between mind and world. In Descartes' dualistic system images and imagination lie just on the frontier between extended matter (subjected to the causal laws of physics) and the ideas which are innate (and ultimately refer to God). Imagination is the (occasional) cause which can make innate ideas pass from potency to actuality. Thus imagination has only a heuristic value. Descartes' general tendency was to exclude all concepts related to images or imagination and to reduce physics to mathematics, and geometry to algebra.[1] This Cartesian strategy still has weight in the sciences, but it is also clear that the dualism between mind and body cannot be resolved in a pure study of the mind that excludes empirical, i.e. perceptually controlled, knowledge from the sciences. Computer science which follows directly in the intellectual tradition of a Cartesian mechanics has led to two different branchings which reproduce the basic dilemma. Artificial intelligence in the more traditional (post-war) style presupposed programmes, organized knowledge systems, and formal grammars for language parsing and production, i.e. an extended set of presupposed mechanisms. The neural net models argue that they can dispense with this mass of blue prints and do the same job using 'neural' connection machines, which

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1 Cf. Boutroux (1900) and Roy (1944).

apply very general learning/adjusting strategies. These connectionist machines are opposed to supposedly innate, prewired, programmed devices. An *imaginistic*[2] model which takes mental images, imagination, as its basic topic refers rather to something we may intuitively experience but which fits neither the theoretical 'machines' of artificial intelligence nor those of connectionists. Thus images are at some intermediate level, between the sensual input on one side and the linguistic account of it on the other. They can be constructed from both sides. This intuitively plausible domain of cognition was neglected or even ignored (supposed to be a subjective illusion or after-effect) in many contemporary theories.[3]

The situation has radically changed since Cooper and Shepard were able to measure experimentally the speed of rotating shapes in mental representation (cf. Shepard 1984 and Cooper/Shepard 1978). It became clear that at least for visual percepts an internal image-like representation exists. The question arose of how this internal representation of objects was related to language understanding and linguistic memory. It was straightforward to assume that words, sentences and texts with rather concrete, experiential content could be related to and profit from internal image-like representations. An early stage of discussion and experimental testing of this hypothesis was Paivio's dual coding theory.

The controversy between a *simple coding theory* of the memory of words, phrases, sentences and texts, which is only propositional, and a *dual coding theory* as proposed by Paivio and others, where imaginistic and (abstract) propositional coding procedures coexist, is decisive for the construction of a cognitive model of language. My position is akin to that of the *dual coding theory,* although I believe that the relation between imaginistic and propositional representations is very rich and variable.[4] The transitions between a propositional and an imaginistic coding allow the coding of propositional content in gestalt-like forms; in another domain a propositional representation can be more effective as a representation of imaginable material in memory (see Anderson/Bower 1973, 452) and an image or an imaginistic representation can be coded as a hierarchical structure using a linear technique (a linear scanning of an image). The important consequence of the controversy between defenders of a propositional and an imaginistic representation is that we have to abandon the reduced notion 'meaning' which we inherited from behaviouristic theories. Chomsky's criticism of Skinner and his stimulus-response theory allowed the consideration of 'mental' objects, but it did not open the way for research into the cognitive (or social) nature of meaning. Imaginistic theories are an attempt to come closer to the phenomenon called 'meaning'.

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2 This term is taken from Kosslyn (1980) and goes beyond visual perception and corresponding schemata.

3 Spatial representations are documented as early as 40,000 years B.C.; one can even argue that the specifically human ability for symbolic representation developed before this date. Human language could have been shaped parallel to this cultural evolution and could have triggered the artistic manifestations found by archeologists. Cf. Davis (1986) and the comments to his article by E. Anati, R. Bedmark and others (ibidem).

4 In Wildgen (1994, Chapter 9) I propose a model based on the notion of information which does not basically distinguish between the two types of *information* and which allows for different types of coding for the same information.

"As it stands the account of linguistic meaning seems to be clearly naive and over simplistic. The addition of mental imagery as a second major cognitive representation within Paivio's model serves to relieve this impression and to make the total system more flexible and more plausible." (Richardson 1980, 109)

I presume that language processing is primarily image-orientated at the textual level, at the subsentential level, however, I assume a more schematic structure mainly for constituents which are the basis of cognitive and syntactic valences (verbs, verbal phrases, some noun phrases, basic sentences) [5].

In opposition to the dual coding theory of Paivio I consider 'meaning' as *one* phenomenon (cf. the criticism of Paivio's naive retention of a submodel of symbolic representation in Richardson 1980, 109). The main conclusion I have drawn from the discussion in theoretical semantics since Bloomfield, Chomsky, Fillmore and many others can be stated as a general *strategy* (programme), which will be substantially elaborated and concretized in the following chapters.

The general hypothesis underlying imaginistic modelling

I assume that an imaginistic level of representation underlies the phenomenon called 'linguistic meaning' This level is intermediate between sequential (linear) organization in language production and the holistic (and distributed) character of those cognitive activities which contribute to meaning.

These cognitive activities encompass:

- higher perceptual activities, where different channels are co-ordinated,
- a higher motor-activity, which contains plans and scripts for complex behaviour,
- memory and imagination as internal cognitive activities which create an internal framework for quasi-perception and quasi-action.

Models of mental representation which establish a link between the symbolic output and the complex cognitive activities mentioned above are called models of *cognitive semantics*. The representations at this level are called *imaginistic*. This term, which is taken from Kosslyn (1980), is opposed to *imaginal* as it covers more than perceptual processes and goes beyond visual perception and corresponding schemata.

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5 Johnson-Laird and Miller (1983) argue that the question of whether meaning is pictorial or propositional is unlikely to be settled by psychological experiments. Common sense and experimental results make it plausible that both aspects have a relevant function in linguistic cognition; I highlight, however, the imaginistic aspect which has received much less acknowledgment in linguistic research than the propositional one (cf. also Sommerhoff, 1990: 214ff.).

Empirical consequence

Imaginistic schemata must have a space-time interpretation and must be qualitatively different from purely sequential systems. As they integrate three basic levels: perception, motor-programmes, and imagination, they must be more qualitative (considering only important features) and more classificatory than physical or perceptual processes.

The terms 'imaginistic' and 'image' may be misleading if not further specified. In everyday life we tend to consider a picture, a pictorial image as the prototype of image. If we consider the different steps of visual representations, this type is rather secondary. Wade (1990, 229) presents the relational network between different types of 'images' shown in Figure 1.1.

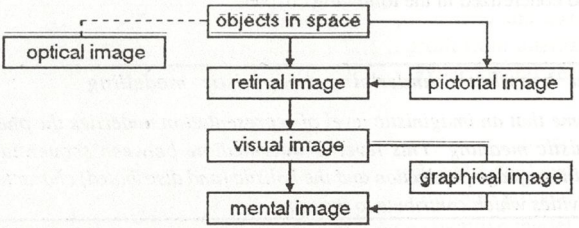

Fig. 1.1 *Relational network of 'images' from Wade (1990, 229)*

The direct line of perception contains 'images' in a metaphorical use of the term, since the representations are continuous and dynamic. The side-lines lead to specific artefacts: the optical projection on a screen, in a camera, and the pictorial and graphical products related either to the objects in space or to the visual image. Here we are only interested in the *cognitive* line of visual (and, in general, sensorial) processing.

2. Ecological realism and cognitive 'meaning'

The 'realism' of the semantics developed in this chapter must be specified relative to two other programmes to which it partially refers:

• ecological realism (in the vein of Bernstein and Gibson's ecological psychology, and the work of Turvey et al.).

• psychophysical holism, which assumes that some abstract information is transmitted (transformed, filtered, etc.) from physical events (in the environment of man) via perceptual processes to cognition (categorization, memory, language).

• experiental realism as a basis of 'Cognitive Grammar' as it is sketched by Lakoff (1987).

2.1. Ecological realism and Fodor's critique

'Ecological realism' is mainly associated with the work of James J. Gibson. The central term in Gibson's theory, which encapsulates the relation between the organism and its (physical) environment, is 'affordance'. The 'affordances' define an intermediate domain between the external world, as it is described in physics, and the internal world described by the physiologist and the psychologist. In short it is a moderate 'scientific realism', halfway between a phenomenological and a realistic (Aristotelian) position. Gibson argues against a psychology which is directly rooted in notions taken from physics and mathematics (geometry).[6]

"But a direct explanation of the perception of the properties of the visible environment may be possible if these properties are taken from concepts of ecology instead of from mathematics and physics. (Perhaps they are ultimately 'reducible' to the latter, but the psychologist cannot wait for such a reduction.)" (Gibson 1982, 401)

"Not only objects but also substances, places, events, other animals, and artefacts have affordances. We might begin with the easy-to-perceive components of the environment consisting of surfaces and surface layouts. And we should assume a human animal as observer, to start with, since the list of affordances will be somewhat different for different animals.

I assume that affordances are not simply phenomenal qualities of subjective experience (tertiary qualities, dynamic and physiognomic properties, etc.). I also assume that they are not simply the physical properties of things as now conceived by physical science. Instead, they are *ecological*, in the sense that they are properties of the environment *relative to* an animal. These assumptions are novel, and need to be discussed." (Gibson 1982, 404)

Other terms for 'affordance' would be valence, invitation-character ('Aufforderungscharakter') as coined by Kurt Levin, or demand-character as proposed by Koffka in his "Principles of Gestalt Psychology" (1935). Based on Gibson (1982, 404 f.), the following types of affordances have to be considered:

1. Surfaces and structures of the ground (stand-on-able, walk-on-able, climb-able, get-underneath-able).

2. Surfaces that reveal or conceal.

3. Objects affording manipulation and related activities (portable, graspable, etc.).

4. Substances that afford pouring (liquids), smearing (viscous substances), being shaped, resisting change of shape, affording nutrition, illness.

5. The affordance of injury or benefit (it can be avoided, escaped, averted or on the contrary be sought after, if perceived).

6. In an environment where we perceive other people who also perceive, the perception of the other is a type of affordance and leads to a generalized perception (we can perceive an object or event from our own perspective *and* imagine how it would be

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6 This tradition goes back to René Descartes, who proposed the integration of physics and psychology.

perceived by other persons). This leads to a level of social perception (every person participates in an environment of common perception).

This sets the stage for a new concept of meaning:

"The notion of affordances implies a new theory of meaning and a new way of bridging the gap between mind and matter. To say that an affordance is meaningful is not to say that it is "mental". To say that it is "physical" is not to imply that it is meaningless. The dualism of mental vs. physical ceases to be compulsory." (ibidem, 409)

It is immediately clear that such a notion of meaning is very useful for research in animal communication, bio- and neurolinguistics. The question, however, of whether it can replace traditional concepts of linguistic meaning (of words and sentences) has led to a controversy which will be discussed later. The linguistic consequences of Gibson's theory of affordances and ecological 'meaning' are developed in Wildgen (1994, Chapter 3).

In the centre of Fodor's and Pylyshyn's criticism stands the *intentional* character of meaning. The important thing in perception is the fact that we see something *as* something, e.g. we see Venus as the Morning Star or as the Evening Star; we distinguish two different properties; being the Morning Star or being the Evening Star. The term 'seeing as' is decomposed by Fodor into: *seeing* and *mentally representing*. In order to recognise the Pole Star *as* the indicator of North, we must know a lot about astronomy and such knowledge only develops very late (historically and ontogenetically). In Fodor's and Pylyshyn's view Gibsonian ecological psychology can only dispense with the construct of mental representation by neglecting intentionality. However, *property* is an (intensional and) intentional notion.

"To say that Gibson has no theory of intentionality is to say that he has no answer to that question [what is it for an event (a configuration of the light, etc.) to specify a *property*]." (Fodor and Pylyshyn 1981, 192).

We shall respond to this criticism immediately, but must first ask how Fodor and Pylyshyn distinguish the two properties; being 'Morning Star' or 'Evening Star'. The answer is trivial: they consider the different linguistic reactions expressed by the nouns 'Evening Star' and 'Morning Star'. When they say (ibid.) "Where the Establishment line offers anyhow, a pious hope, the Gibsonian offers only a dead end" we believe that this is comparable to the case of two engineers who want to build a tunnel. One of them composes poems about the wonderful world on the other side of the tunnel and blames the other that his tunnel is a 'dead end', the second one continues digging in the direction which, in his view, allows him to break through the rock.

The fundamental problem of intentionality (the force field linking the individual to some goal) is solved at a more basic level in ecological psychology than it is in a theory of representation. The ecological realist starts from a relational structure in which an organism is linked to the environment (ambient energy). The relation already contains intentionality. The representationalist first neglects the environment (reality) in his search for a central place where all processes of perception converge (the brain, some specific 'organ' in the brain, an assembly of neurones, the grandmother cell). Later, intentionality reminds him that he has lost a major part of the functional whole

(cf. Turvey/Shaw/Reed/Mace 1981, 292-298). Thus it is not ecological psychology which is inadequate for not considering intentionality, it is representationalism, which treats intentionality as a purely internal (solipsistic) phenomenon.

The reason why ecological realism is appealing to semiotics is that its premise is more natural and less artificial. A consequence of these deeper roots is, however, that it is easier to treat linguistic meaning in terms of specific linguistic manifestations (giving a shallow account of meaning) than to link linguistic meaning to fundamental laws of biomechanics and biology.

The new paradigm, which uses laws governing the external world (physical, chemical laws) and the organism (biomechanical, biological, neurodynamic laws) in the construction of a model of meaning, is called 'realistic semantics'. The adjective 'realistic' is specified by the specific elaborations of the view in ecological psychology and in semiophysics.[7]

We shall discuss the use made by Barwise and Perry (1984) of these basic positions and its criticism by Lakoff (1987) in order to specify the contours of the programme of *realistic* semantics.

2.2. The philosophical position of situation semantics

In their introduction Barwise and Perry (1984) state the central assumption of ecological realism: "There is much more meaning and information in the world and less in the head than the traditional views of meaning assumed." (ibid.: X) This does not mean that everything relevant for meaning is in the world outside, nor that this 'meaning' is projected with high fidelity and without choice, loss, mixture, addition, etc. into higher cognitive structures. As in a typical case of a paradigm change, one is forced to see all the known facts under a new basic assumption: *physical and ecological information is a possible source and explanation of meaning*.

The major problem with this kind of realism is the answer to the sceptic who asks: What is reality (environment)? How can we know (without doubt) what reality is? Does our understanding of reality (categorization, linguistic description) follow from reality or rather does it constitute reality?

It is the answer to precisely these questions which defines a specific type of realism. In the case of Barwise and Perry their realism is part of a test in which they define 'situations' (real, abstract), 'situation types', and 'structures of situations'.

The term 'situation' refers to static situations, called 'states of affairs' and 'more dynamic situations, called events' (ibid.: 49). The term 'more dynamic' is revealing. In fact neither kinematic nor dynamic aspects are preserved in the core of the model, as will be shown.

a. The primitives of the model (cf. ibid.: 50f) include:

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7 A common background is the Neo-Aristotelian approach of Brentano and Thom. A comparative analysis which searches for common roots of both enterprises is lacking. As Thom's programme is primarily motivated by the developments in mathematics (topology) between 1950 and 1970 such a comparison would be very complicated (cf. Wildgen 1985b).

• Individuals and collections of individuals.

• Relations (0,1,..., n place relations) and collections of relations. As in logical semantics verbs are interpreted as relations (it is raining: 0-ary relation, being asleep: 1-ary relation, kicking: 2-ary relation).

• Space-time locations and collections of space-time locations.

Changes in space-time are defined by relations between space-time locations associated with situations or situation types. The 'kinematics' are, therefore, reduced to statements about precedence, overlapping, inclusion. Stability, motion, acceleration, the basic ideas of Archimedes and Galileo, are not existent in this framework. In this sense situation semantics can be said to have no kinematics (on the theoretical level established by the work of Archimedes and Galileo).

b. One can only call a model 'dynamical' if forces, causes, processes are the central concern. Kepler introduced dynamical considerations into physics and Newton established the classical paradigm of dynamics.

The model proposed by Barwise and Perry (1984) maintains that the relation between real situations and abstract situations is a metaphysical one; in fact only abstract situations are relevant for the model and the "belief in one big situation" called "Reality" is "all that is required" (ibid., 60). Abstract situations (states or events) are simply set-theoretical constructs.

"An abstract state of affairs or course of events is a set. It is not perceived, does not stand in causal relations to other abstract situations, and does not occur in nature ... Real situations are not sets, but parts of reality. They are perceived and stand in causal relations to one another. They comprise what might be called the causal order" (ibid., 58).

On the one hand it is trivially true that models and descriptions are not causal in themselves, on the other hand, if forces, causes, and processes are constitutive for the reality modelled, the organization of the model must match this basic feature (not peripherally but directly in the basic structure of the model). This is just what Copernicus did when he replaced the geocentric system with the heliocentric one. As Kepler made clear later, the sun is the central cause of the stable and regular motion of all planets. In this sense situation semantics cannot be called 'dynamical'; it remains in logical semantics' universe of discourse even if Frege's holism is partially dropped; it is not "realistic" in an advanced sense.

2.3. The experiential realism of 'cognitive semantics'

Lakoff (1987) develops Putnam's (1980) argument against 'objectivistic semantics' in Part Two, entitled "Philosophical implications". In Chapter 16 he outlines "A new realism" (ibid., 260-268)[8]. It is not our concern here whether Lakoff's (and Putnam's) criticism of the so-called 'objectivistic paradigm' is valid, we shall ask instead if the programme of 'experiential realism' is sufficient and how it is related to

8 Adopting a term from Putnam (cf. ibid: 260), the 'objectivistic' position is called 'metaphysical realism'.

the 'ecological realism' of the semantics developed in this chapter. Let us first examine Lakoff's description of 'experiential realism':

"The experientialist approach is very different to attempts to characterize meaning in terms of *the nature and experience of the organisms doing the thinking*. Not just the nature and experience of individuals, but the nature and experience of the species and of communities. "Experience" is thus not taken in the narrow sense of the things that have "happened to happen" to a single individual. Experience is instead construed in the broad sense: the totality of human experience and everything that plays a role in it - the nature of our bodies, our genetically inherited capacities, our models of the physical functioning in the world, our social organization, etc." (ibid., 266).

This statement makes it clear that 'experiential' realism is objective and not subjective. The main point is that meaning is not just a mapping of utterances onto (meaningless) formal representations of objects, situations, etc., but a mapping of meaningful utterances onto meaningful prelinguistic, sublinguistic structures (Lakoff calls them 'preconceptual'). But where do these (preconceptual) 'meanings' come from? In order to avoid 'objectivism' they must come from other meaningful structures (in the environment) and these come from meaningful structures which are evolutionarily deeper, and finally we must accept some cosmological meaning in the big bang. If Lakoff prefers to avoid this regression, he must introduce some act of creation of meaning, which would take us back to the 18th century controversy about the heavenly or natural origin of language.

Since Lakoff accepts neither a cosmological regression nor an act of God as being responsible for the creation of meanings, he has to postulate some other plausible origin. He decides that this point lies beyond perception, as his criticism of ecological realism shows: "Part of Gibson's ecological approach is absolutely essential to the experientialist approach that Johnson and I have proposed: his stress upon the constant interaction of people with their environment ... But in the realm of cognition, ecological realism cannot account for most of the examples in this book" (ibid., 261f).

Consequently, the psychological zone, which is below perception and *a fortiori* the objective structure of the world around us (the environment), is below the threshold where meaning starts.

But where is this level below *linguistic* meaning, this level of preconcepts, and how can it be empirically assessed? Is it really different from the linguistic level or is the semantics of a word, a sentence, a text in one language just a mapping onto words, sentences, texts of another language, i.e. a translation e.g. into English or into an artificial language, inductively construed by considering the grammatical distinctions in some typologically divergent languages?[9] In each case such a position is open to Lewis' (1972) criticism that Fodor's semantics just translates one set of symbols into another. Lakoff (1987, 205f) accepted this criticism but denied its applicability to experiential semantics:

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9 The index in Lakoff (1987) refers to: Atsugevi, Cora, Dani, Djirbal, Fox, Hawsa, Japanese, Ojibwa, Shawnee, Tamahura. (If we assume that there are 5,000 different languages actually spoken, this is a sample of 0.2 %.)

"What keeps the Lewis critique from being applicable to cognitive models is *embodiment*. Cognitive models that are embodied are not made up merely of items in an artificial language. In experientialist semantics, meaning is understood via real experiences in a very real world with very real bodies. In objectivist accounts, such experiences are simply absent" (ibid., 206).

Lakoff says 'real' three times in his last sentence, but how does he empirically get in touch with this 'reality' (remember that it is not individual, subjective 'reality'). The Case Studies in his book show that he contacts this reality only by applying his personal intuition to linguistic expressions. This is just the method which every semanticist cannot avoid applying. There is no new 'reality' in experiential realism, there is just a new technical lexicon for intuitive semantics. The question asked above: "Where is the level below the linguistic level?" receives a trivial answer: The intuition of the linguist is this level. Is this level 'really' below the level of normal communication by language users? Can this 'reduction' to preconceptual structures explain meaning? It could, if non-linguistic evidence were constitutive for empirical analyses conducted under the heading of experiential semantics. The fact that Lakoff decided to stop the regression towards non-linguistic meaning at a very shallow level means that his programme, which is appealing, does not move 'semantics' out of the range of language-internal, purely introspective descriptivism.

If semantics is defined as a model which maps utterances onto something different, ontologically prior, experiential semantics is only an internal description of language use and not semantics at all (historically it follows in the tradition of structural semantics which started with field-theories in the twenties and does not really go beyond this paradigm).

2.4. The programme of realistic semantics

"Realistic semantics" share some features with all the programmes discussed in the previous sections:

a. It is 'objectivistic' in the sense that the knowledge accumulated in major sciences like physics, chemistry, biology, neuropsychology, and the strategies of these disciplines for contacting 'reality' are considered as fundamental to any theory of meaning. They are able to specify how the world (in its stable and regular, i.e. knowable aspects) really is. This objectivism is by definition experiential, it has assimilated the experience of millennia and of all societies which developed a scientific concern with the world. Since Lakoff defined 'experiential' as supra-individual and trans-societal, scientific knowledge is just collective experience.

b. It is 'realistic' in the sense that it is anti-sceptic. Philosophically it is not possible to refute scepticism, which doubts 'reality', but scientifically 'scepticism' is not productive. Thus, if no definite security about reality can be attained, a scientific endeavour must start from the best knowledge that we have about the world. Following Penrose (1990, 197) one can distinguish between SUPERB, USEFUL, and TENTATIVE theories. SUPERB theories would be good candidates for an outline of reality and should be used by a semantics labelled 'realistic'. Penrose specifies the

category of SUPERB as follows:

"To qualify as SUPERB, I do not deem it necessary that the theory should apply without refutation to the phenomena of the world, but I do require that the range and accuracy with which it applies should, in some appropriate sense, be *phenomenal*. The way that I am using the term "superb", it is an extraordinary remarkable fact that there are any theories in this category at all!" (ibid., 197).

Penrose enumerates:

1. Euclidean geometry (as a theory of physical space and rigid bodies),
2. statics (Archimedes, Pappos, Stevin),
3. Newtonian mechanics (the development of Galileo's dynamics),
4. Maxwell's electrodynamics,
5. Einstein's relativity theory,
6. quantum mechanics,
7. quantum electrodynamics.

The theories (3) to (7) are all dynamical theories and they presuppose the theories (1) and (2).

A realistic model of meaning should at least be based on the knowledge about the world contained in SUPERB theories. If semantics as a scientific endeavour is rather 'tentative' it can also presuppose the view of the world contained in USEFUL and TENTATIVE theories. It should, however, be aware of the different degrees of security in its assumptions about the world. As these theories are the product of human intelligence and labour, the world-view which they contain is "ipso facto" experiential.

The advocates of experiential realism could object that the scale of excellence of theories is inversely related to their relevance for language, i.e. SUPERB theories are about cosmic laws and all theories pertaining to biology or psychology are either at the level called USEFUL (such as the theory of evolution) or TENTATIVE. Consequently, the semanticist would have to choose:

- either to be *realistic* and connect meaning phenomena to the world as described by SUPERB theories,
- or to be *relevant* and accept the risk of having no realistic foundation.

We shall show that both goals can be reached. However, the goal of realism has priority as 'relevance' is a very subjective criterion. I suspect that 'relevance' often corresponds to the proximity to trusted views and if one gives priority to this vague criterion one ends up in worthless repetitions of current prejudices.

For realistic semantics we assume:

- a continuity of basic laws and principles valid in the macro-domain (the dynamics of the world), in the meso-domain (the environment of man) and in the micro-domain (the domain of first constituents),
- further, more specific regularities in the meso-domain must still be discovered

and should be added to the basic laws mentioned above,

• the experiential domain in the sense of the observer's individual experience is only a partial and momentary view of the experiential totality of man; these pieces can only be understood if we have some understanding of the system as a whole.

In this sense single descriptions are interpretative (hermeneutic). This does not mean that the whole enterprise is *only* an arbitrary construction, a piece of argument without any claim to realism. The realism assumed in this book is founded on three pillars.

1. The pillar of SUPERB theories, which shows that modern dynamics are fundamental for the understanding of the world.

2. Perception is intimately linked to action in a specific environment. The environment itself contains 'affordances' for action and sets the conditions for their success or failure. This is immediately true for locomotion and direct actions on the environment. By evolutionary continuity these affordances have an impact (with some deformations and possible feedbacks) on higher levels of cognition in a human, i.e. a social, interactive world. It is evident that the linking of higher cognition to the affordances of an environment has more degrees of freedom and that the environment inherits features created at the cognitive level. Therefore, by way of self-referentiality (or by 'accommodation' in Piaget's terms) the causal link between environment and mind becomes more complicated. The realistic position assumes only that the control by the *general* type of environment we live in is not lost and that basic organizational properties of the fundamental link between environment and cognition persist. This assumption can explain the stability of cognitive systems in a world which is only superficially affected (not in its basic laws) by man's cognitive projections (by artificial 'worlds'). It is clear that assumption (2) is open to philosophical debate, but a stability orientated analysis should start on this ground. (If we wanted to analyse the stochastic or the chaotic character of human cognition, the opposing starting point could be appropriate.) In the long run both aspects: stability control by the environment and diffusion and chaotic constructivity, should together contribute to a unified theory, which only the future can bring (cf. Wildgen 1994, chapters 3 and 4 for application of this double strategy).

3. Semantic categorization in language is linked to the basic realism, outlined in assumptions (1) and (2) above, on a rather abstract level. Firstly, there are basic domains immediately related to perception and to the control of locomotion, action, immediate, and mediate (instrumental) causation, etc. These domains are, therefore, the best starting point. Secondly, more abstract low-dimensional (i.e. 1, 2, 3 dimensional) semantic spaces can be defined in which processes similar to those in the 'localistic' domain can be observed, (cf. Wildgen 1994, chapters 3 and 5).

Some consequences of the underlying dynamics can be observed immediately; we can, therefore, ensure that assumption (1) is relevant for language. In the following chapter basic phenomena of multistability (in an equilibrium system) are shown with reference to the classical domain of lexical and syntactic ambiguity.

In general the realistic position is limited by the impossibility of reconstructing

the historical dynamics in full detail, and by the complexity of dynamical processes with different temporal and spatial extensions and their modes of overlapping. These limitations are, however, no argument for scepticism, the realistic programme allows us to overcome (partially) these limitations by the choice of plausible assumptions, which are later evaluated on the basis of their consequences, and by the search for new domains of observations, which allow us to fill the gaps in our knowledge.

The realistic perspective can be called an 'entrepreneurial' perspective, whereas the sceptical (or instrumentalist) perspective could be called bureaucratic, it aims only at an administration of our lack of knowledge (often within the narrow confines of disciplines and sub-sub-disciplines).

3. Multistability and catastrophic changes in meaning

In the real world highly ordered equilibrium situations and structurally stable transitions between them are rather the exception; they are those 'islands of order' which are of primary importance for any science and especially for a developing sub-discipline with poor experimental and empirical techniques, like semantics. In Wildgen (1982, 1985a, 1987, 1988, 1990, and in Chapter 3 of Wildgen 1994) these aspects are systematically investigated.

A borderline case is that of multistability. If two or more attractors have similar weight (depth), the dominant state of a dynamical system can jump from one to the other and it can show hysteresis and delay.[10] If the character of the attractors themselves changes, they can become "strange attractors", the dynamical system moves towards chaos.

The treatment of semantic multistability in realistic semantics will show that new domains of analysis are opened which were considered as marginal in classical models because they did not fit the presupposed analytic techniques and modelling devices.

3.1. Ambiguity and multistability in linguistic meaning (in relation to perceptual multistability)

Within the framework of ecological semantics we should try to found the analysis of linguistic ambiguity on an analysis of perceptual multistability.[11] In order to give an answer to the question, whether semantic ambiguity is in some way related to perceptual multistability, we must first describe the levels of perceptual multistability which could be relevant for such a comparison.

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10 If the process is conservative the jump occurs with a certain delay, i.e. the dominance of the attractor must reach a certain value before the state changes. As the point of jumping changes with the direction of the process, the system has a kind of dynamic memory. Hysteresis follows from delay, if the underlying path is cyclic.

11 This chapter was first written for an interdisciplinary symposium on "Perceptual Multistability and Semantic Ambiguity" held in Bremen in March 1993. Cf. Stadler and Kruse (eds.) 1994.

3.1.1. A rough classification of perceptual multistability

In 1832 the Swiss crystallographer L.A. Necker described the classical multistability of a three-dimensional regular geometrical object if it is represented in two dimensions (without depth deformation). Figure 2 shows this classical case, called the Necker cube.

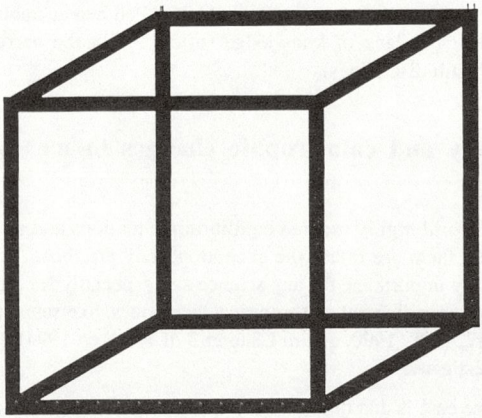

Fig. 2 *The Necker cube*

If we take a shape in two dimensions with clear contours, we can observe a bistability in which the figure/ground distinction changes (see Figure 3):

- (left): rabbit <-> duck
- (right): one cup <-> two faces

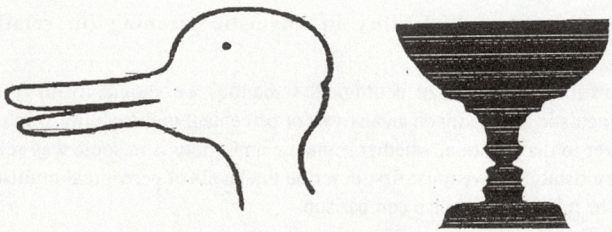

Fig. 3 *Two examples of 'semantic' multistability in perception*

Other examples can be transformed from a non-ambiguous figure, through a set of intermediary pictures which are ambiguous, into another unambiguous figure. A classical example is shown in Figure 4.

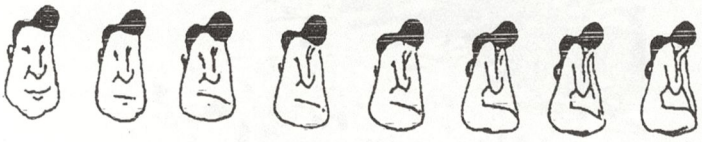

Fig. 4 *The transition from: old man <-> young woman*

Perceptual multistability can also occur independently of semantic interpretation. Rubin (1886-1951) analysed the configuration made up of segments of a circle and rays (see Figure 5).

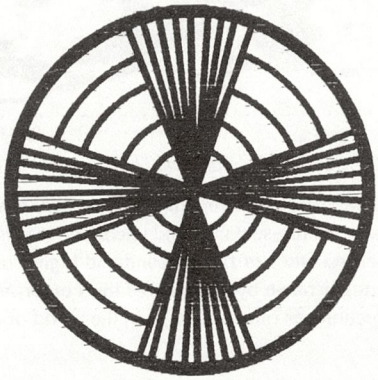

Fig. 5 *Rubin's example of multistability*

If the rays are seen as figure, the circle segments are seen to belong to coherent circles in the background.

This first series of multistable figures is related to the mental reconstruction of a three-dimensional (meaningful) picture on the basis of the two-dimensional retinal distribution of luminosity.

3.1.2. The perception of textures

The examples given in the Figures 2 to 5 are very convincing, as everybody can experience the effect: they are accessible to conscious experience. Our perception of textures, as Figure 6 shows, is only accessible insofar as we experience a transition from disorder/homogeneity to order and heterogeneity.

Fig. 6 *The perception of textures (a Dalmatian dog)*

Julesz and his co-workers have shown that the recognition of textures is a phenomenon which appears at a pre-semantic and unconscious stage of perception. He proposes a model in which statistics of first, second and higher order are relevant. If two textures are only distinguishable by statistics of third order, most animals cannot distinguish them. Many techniques of camouflage in the world of animals exploit this basic fact.

3.1.3. The spatial rotation in mental imagination

If textures involve very automatic, preconscious perceptual strategies, the rotation of pictures and objects in our imagination is a kind of conscious mental 'work' which is experienced as taking time and costing energy. Therefore, these processes point to a third level of multistability: *A set of different contours can be matched to one contour or not.* The fundamental bistability which is the result of mental rotation is, therefore:

- identity (through transformation)
- non-identity (through transformation)

In addition, we experience the effort of such a matching (some are easier, quicker, others are more complicated, slower). Figure 7 shows some of the contours tested by Cooper and Shepard (1986, 124).

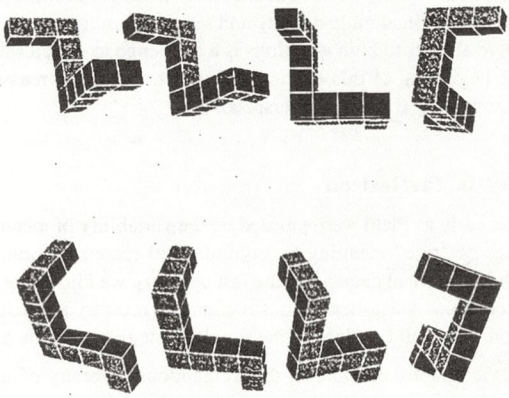

Fig. 7 *The experiment of Cooper and Shepard (1978)*

In order to answer our basic question, we must ask if one, several or all of these types of multistability have an analogue in semantic ambiguity in languages.

On first impressions semantic ambiguities seem totally independent from perceptual ones since the perceptual domain in language is that of phonetics and not that of syntax and semantics. The arguments for such an independence could be as follows:

a. Language, as a system of symbols, pertains to the level of consciousness or even to a level beyond consciousness insofar as language is a system of conventions which presuppose a social system from which these conventions emerge. The only level at which perceptual processes are related to language would be the level of conscious transformations analogous to the mental rotations described by Cooper and Shepard.

b. The standard examples of multistable perception (in Figures 2 to 5) presuppose a three-dimensional object, whose perception is based on two-dimensional retinal input. If the test object is two-dimensional, the recognition of textures and the figure/ground distinction are the central problems. However, language is commonly considered to be a linear structure. Therefore, the problems of visual perception and the multistabilities in their solution should be irrelevant for languages. Moreover, spatial objects are continuous (between borderlines), whereas language is considered to be discrete (in its units).

Both arguments are convincing if we accept their premisses. We, therefore, must first critically assess these premisses and ask:

• Does language and specifically the construction of meanings use unconscious, automatic and self-organizing processes (as perception does)?

• Is linguistic meaning based on continuous scales and low-dimensional geometrical/topological representations?

As the reader can already guess, our answer to these questions is a positive one; the relation between perceptual multistability and semantic ambiguity does make sense. However, a positive answer to both questions is a challenge to structuralist semantics, established at the beginning of this century. We must, therefore, reassess the major facts of semantic ambiguity from a new perspective.

3.2. Ambiguities in the lexicon

Thinkers as early as Plato were puzzled by the variability of meanings and tried to find the sources of "true" meaning by etymological reconstruction. After a long period of research in historical change (in the last century), we know that the origins of language are inaccessible to historical reconstruction; we must try a synchronic analysis of the phenomenon. We shall first look at the way lexicologists treat the problem.

Current lexicography documents the tremendous diversity of meanings. For instance Webster's Encyclopedic Dictionary distinguishes 24 specific meanings of the word 'eye' as a noun (and 21 uses in specific locutions) and 3 uses as a verb 'to eye'. Some of these are rather distant from the meaning of the perceptual organ called 'eye'.

Examples:

13. The butt of a tomato

16. The hole in a needle

23. Winds and fair weather found at the center of a severe tropical cyclone.

Multiple meanings are also typical for other body parts such as *mouth*. The underlying processes which explain this diversity can be called metaphor (diffusion of meaning by similarity) and metonymy (transition from parts to wholes and vice-versa).

If no common historical origin exists (or if the commonality is hidden) the words are called homonyms (homophones, homographs); they have categorically different meanings (and are, therefore, called polysemous). The distinction between detectable and hidden identity operates on a scale of analysability which is continuous. Thus the basic distinction between variants of meaning and different meanings is a continuous scale, which we can call *the scale of semantic categorization.*

Examples of polysemy (see Webster 1978, 447f.)

ear^1 the organ of hearing (subdivided into 22 specific meanings or uses)

ear^2 part of a cereal

It is very difficult to decide by the similarity of forms appearing under *ear*^{1} if *ear*^{2} has some similarity with *ear*^{1}. Etymological knowledge is used in the lexicon for a clear distinction:

ear^1 Lat.: auris

ear^2 Lat.: acies

This etymological knowledge is mostly not accessible to the average language user and, therefore, irrelevant for his semantic 'perception' of the two words.

Moreover, diachronic pathways can be complicated and multiply interrelated. (As language contact and lexical borrowing between Indo-European languages is a common phenomenon the same etymon can enter a specific language at different periods with different meanings.) The distinction between two words can, therefore, even appear if the etymon is the same, as in:

bank[1]: 1. A long pile or heap; mass:

a bank of earth, a bank of clouds.

[ME: banke]; 16 variants and uses

bank[2]: 1. An institution for receiving, lending, exchanging, and safe-guarding money.

[It. banca, OHG bank = bench]; 11 variants and uses.

bank[3]: 1. An arrangement of objects in a line or tiers.

[OF banc < GMC]; 10 variants and uses.[12]

In French, Italian and Spanish two genders exist and differentiate two groups of meaning:

Table 1 *The differentiation in French, Italian and Spanish*

language	translations of bank[1] or bank[3]	translations of bank[2]
French:	banc[1] (m) siège étroit	banque (f) entreprise commerciale
	banc[2] (m) amas de sable	
Italian:	banco (m) seat	banca (f) institûtion
Spanish:	banco[1] (m) asiento largo y estrecho	banco[2] (m) establecimiento público de crédito
	banca[1] (f) asiento de madera sin respaldo	banca[2] (f) comercio de dinero y crédito

The Spanish example shows that both forms (banco, banca) have a similar differentiation; in Italian we find compounds with the meaning of 'banca' but the form of 'banco': bancogiro, banconota.

These few examples, which are symptomatic for the lexicon as a whole, show that lexical ambiguity is due to the following processes:

a. historical change in meaning and borrowing (from sources which have been fixed by historical changes),

12 OHG = old high German, OF = old French, GMC = common Germanic (Webster's, 1978:117), ME = Middle English.

b. meaning diffusion by metaphor and metonymy.

Further sources of lexical ambiguity are the external (denotational) and the syntactic context. If we compare translations of the German verb 'aufziehen' (see Wunderlich 1980, 30) into French and English we come up with a list of very divergent meanings in context.

Table 2 *Translations of the German verb 'aufziehen'*

transitive use			**intransitive use**		
French	(context)	English	French	(context)	English
lever	(curtain)	open	s'élever	(thunderstorm)	approach
hisser	(flag)	hoist			
monter	(picture)	mount	monter	(the guard)	draw up
élever	(child)	raise	(la garde)		
remonter	(toy)	wind up			
arranger	(meeting)	organize			
railler	(persons)	tease			

If lexical ambiguity in the shared lexical knowledge is explained by historical processes, then individual meanings can be explained by processes of linguistic development. Labov and Labov analyzed the use of the words 'mama', 'dada' and 'cat' by their child between the 15th and the 17th month (see Labov 1978, 232-235).

mama: In the 16th month all members of the family could be called 'mama', the statistical trends towards the final designatum (the attractor of the process) were already clear:

mother (67 uses), father (13), sisters and brothers (1, 7, 16, 13).

In the 17th month the ambiguity was reduced to mother (420) and father (52) and disappeared thereafter.

dada: The word 'dada' was first used in the 17th month. It was ambiguous relative to father (89), brother Simon (10) and sister Sarah (1). Later the statistically dominant father became the unique person designated by 'dada'.

cat: This case is different from the first two as the final attractor of the meaning is not an individual (a member of the family) but a species. The child concentrates on specific features, the implicit definition of 'cat' is 'analytic'. Some criteria are preferred to others. For this child the roundness of the head seemed to be the dominant criterion.

As a consequence of this purely illustrative analysis of a semantic development, we can state two further trends.

c. The lexical designation of specific individuals starts with a statistical field

with attractors and eliminates smaller attractors until *one* individual is left.

d. The content of a classifying label is given its first contours by preferences for certain features and ends up with a sharpening of these preferences. As a consequence the categorization remains vague and is orientated towards one (or a few) *prototypes*.

A central question for semantic analysis which follows from (d) is:

What are the underlying semantic qualities on which a preference scale is built? Are there 'inbuilt' preferences related to perceptual cues (form, colour, behaviour, etc.)?

3.3. Perceptual scales underlying lexical ambiguity

We shall report first the results of a classical study done by Labov (1973) in order to prove our basic premise, that a perceptual continuum underlies semantic ambiguities. In addition this example shows that the real or imagined context is a strong determinant in disambiguation.

Labov presented two-dimensional pictures of containers with a handle but with varying depth and width. We shall only consider variations in diameter. The 24 test-persons had to label these pictures in two contexts:

n: neutral context: no further specification,

f: food-context: the test-persons had to imagine food in the containers.

Figure 8 shows the series of pictures, Figure 9 the consistency profiles (% of consistent responses).

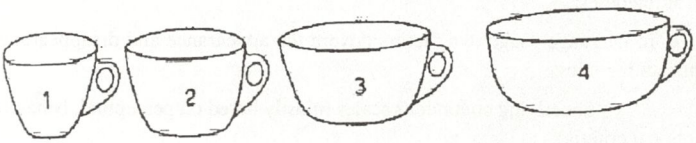

Fig. 8 *Series of pictures*

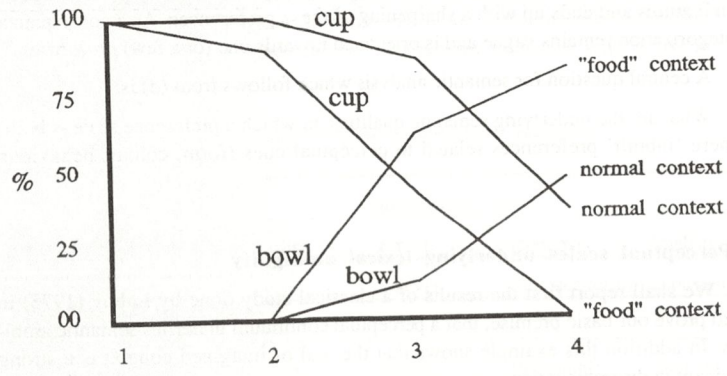

Fig. 9 *Consistency profiles*

In the food context, pictures 2 and 3 are already strongly ambiguous, picture 3 is by preference labelled as 'bowl', whereas in the neutral context the dominant labelling as 'bowl' occurs only in picture 4.

The general trend shown by these results motivates a further hypothesis about lexical ambiguities:

e. In language usage two factors govern the appearance and disappearance of semantic ambiguities:

- underlying continuous scales (mostly based on perceptual, behavioural or emotional criteria),
- imagined or real contexts of use.

A second favoured domain of analysis of perceptual effects in semantics is the domain of dimensional adjectives such as: long, deep, high, broad, etc. It is specifically tuned to the perception of space and spatial features. I shall, therefore, discuss a specific lexical ambiguity which occurs when several such adjectives are used in order to characterize a three-dimensional object.

In a study on dimensional adjectives (DA) Lang (1987, 297) considered sentences of the following type: *x is m_1 DA, m_2 DA' and m_3 DA"* where x is the subject of the sentence (denoting a three-dimensional object), m_i are measurement expressions like 1 metre, 50 cm, etc. and DA, DA', DA" are different dimensional adjectives.

The ambiguity Lang discovered concerns the dimensional adjectives chosen to describe a board. The breadth of the board is either called "breit" (broad) or "tief" (deep). The second use is triggered by the context, in which the board is used as a window-sill and is seen (or imagined) as part of a three-dimensional window-frame. If seen as a raw board in a stack, the DA "breit" (broad) is preferred. Talmy (1983) previously gave a framework for the interpretation of this observation by Lang, as he distinguished several imaging systems. One of these is related to an imagined eye and refers to a body-centred perspective. This imaging system is triggered by the context "window-frame", the dimension "breit" becomes "tief" (deep). As a further consequence the DA "breit" replaces "lang" (long)[13]. It seems that in the underlying hierarchy we had first:

(neutral context)	lang	1 m	breit	30 cm

then the interpretation shifted to:

(window-frame)	breit	1 m	tief	30 cm

This peculiar example of combined lexical ambiguity shows how mental imagery underlies the phenomenon of lexical ambiguity. In this particularly rich case two adjectives change their meaning (in context) in an interdependent way and we can assume that there is an underlying set of "imaging systems" (as Talmy proposed). The multistability concerns primarily the imaging systems and triggers a complicated redefinition of lexical items.

3.4. Lexical ambiguity based on an emotional scale

The Black American use of 'bad' is ambiguous insofar as it can have a negative as well a positive meaning. If we start with a basic emotional parameter 'approval - disapproval', we can arrange the unambiguous adjectives: super, OK, so-so, lousy, awful, and the ambiguous adjective 'bad' as clouds around this axis.

Figure 10 (see Poston 1987, 29) gives an initial representation of the overlapping of bad_1 (approval) and bad_2 (disapproval).

13 Another interpretation was suggested by Pottier (oral comment); the board inherits the dimensional labelling from the window-frame. In this case Talmy's "imagery system" is permanently applied to the window-frame and inherited by the board.

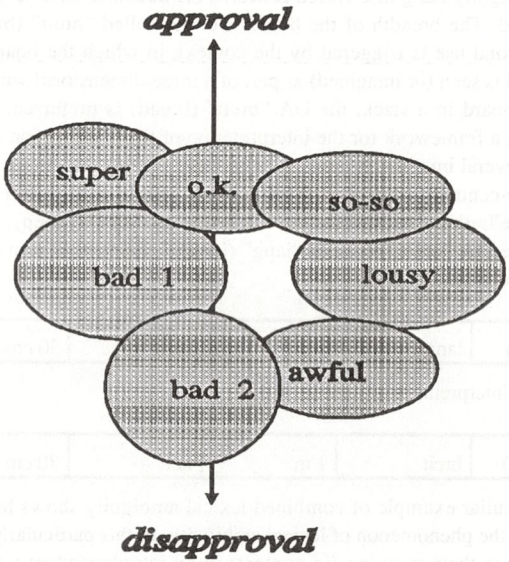

Fig. 10 *The cloud of overlapping semantic areas*

The bistability of the situation, the existence of a neutral zone, the sudden shifts (catastrophes) between bad_1 and bad_2, which depend on small changes in the context of its use, lead Poston to propose the catastrophe called 'cusp' as the underlying schema. Figure 11 shows a reorganization of the field of adjectives on the surface of critical points in the unfolding of the cusp.

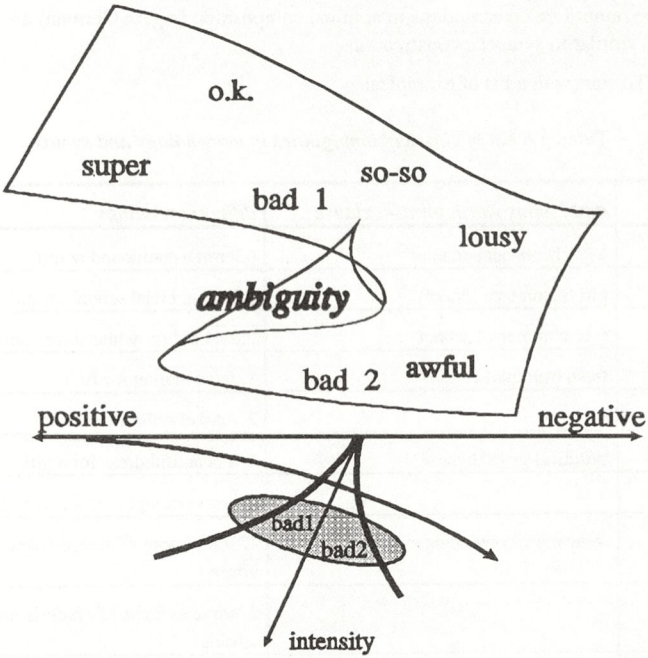

Fig. 11 *The cusp fitted to the bistable behaviour of the field*

In Figure 11 the relevant external variables which govern the catastrophic and smooth changes in the field of adjectives are labelled P = Positivity and I = Intensity.

• If intensity (I) increases, the bistable situation appears, if it is low, no bistability occurs, as in: OK, so-so, lousy.

• If positivity (P) changes from positive to negative, the interpretation of 'bad' changes suddenly, from bad_1 (positive, intensive) to bad_2 (negative, intensive).

3.5. Morphological and syntactic ambiguities

In the section on lexical ambiguity we considered a unitary word (either a simplex, or a stem with bound morphemes). In this section we consider structures consisting of more than one free unit. The source of ambiguities lies in the constructions and befalls the constructional meanings.

The analysis of morphological and syntactical ambiguities is, therefore, fundamentally different from the analysis of lexical ambiguities.[14] Morphological ambiguities are considered as a phenomenon in the transition to syntactic ambiguities.

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14 It is clear that lexical ambiguities are inherited and partially eliminated by constructions.

Thus the rather free constructions in nominal composition (e.g. in German) are in many respects similar to syntactic constructions.

To start with a list of examples:

Table 3 *A list of classical ambiguities in morphology and syntax*

	ambiguous word, phrase, clause	*different readings*
a.	Mädchenhandelsschule	(German compound noun)
	girl (commerce school)	1.a commercial school for girls
	(girl commerce) school	2.a school for white slave commerce.
b.	fresh fruit market	1. fresh market for fruit
		2. market selling fresh fruit
c.	beautiful girl's dress	1. a beautiful dress for a girl
		2. dress belonging to a beautiful girl
d.	some more convincing evidence	1. some more evidence (which is convincing)
		2. some evidence (which is more convincing)
e.	flying planes (are/is dangerous)	1. planes which fly (are...)
		2. to fly planes (is...)
f.	the shooting of the hunters	1. the hunters shoot
		2. the hunters are shot
g.	amor Dei	1. God loves
		2. God is loved
h.	Dico Clodiam amare Catullum	1. Clodia amat Catullum
		2. Catullus amat Clodiam
i.	Jean fait manger les enfants	1. les enfants mangent
		2. les enfants sont mangés

If we analyse these examples we can conclude that two basic types of syntactic ambiguity exist.

1. If we have two constituents of a syntactic construction, the relation between these constituents is either symmetric (this is an unstable borderline case) or asymmetric. In the normal case of asymmetry the constituent on the left or the right is the centre, the other is the periphery. In most languages the place of the centre is typologically stable; therefore, this source of ambiguity is rather incidental. (But

consider: is axe-hammer more a hammer or an axe?) Is the proper name in 'uncle Watson', 'President Watson' the centre or the periphery of the noun phrase?

2. If we have more than two constituents and if the principle of centre vs. periphery works, then we have three possible constructions (C = centre, P = periphery):

a. P_1, P_2, C

b. P (= two constituents), C

c. P, C (= two constituents)

If more than three constituents are present the structural ambiguity increases very quickly. This source of ambiguity could make complex constructions impossible. Every natural syntax must, therefore, have a set of devices in order to limit this danger of disorganization. The main function of syntax can be seen in such a control of chaotic ambiguity. The major strategies are:

1. The constituents are morphologically classified by bound morphemes, e.g. by case-forms. Syntax rules which refer to case classification control the grouping of verbs with different types of objects, of subjects with their verbphrase, of adverbs with verbs, adjectives with nouns, etc.

2. The order of appearance and the proximity of two constituents in an utterance can be a signal for a common construction (if no information of type (1) is given or if this information is insufficient).

3. Bound morphemes around the verbal stem can show the type of noun phrases which may specify the central meaning (this is a technique found in many American Indian languages).

4. Discontinuities of stem and bound morphemes can frame a systematic construction (in German the auxiliary and the verb stem can mark the contours of a verb phrase).

Example:

Er *hat* den ganzen Kuchen *aufgegessen*.

5. Binding phenomena (congruence, pronominal coindexation) can relate constituents.

Syntactic ambiguity appears if these devices do not work. The situation is, therefore, basically different from perceptual multistability, where stability is the normal case; in syntax chaos would be the normal case and complicated filters reduce this chaos, but some islands of multistability remain (for contextual disambiguation).

In certain cases we have underlying (deep) semantic scales. We shall concentrate on these examples.

3.6. Semantic scales underlying syntactic ambiguity

The examples (e) to (i) above all have a transitive verb as the centre of the construction:

e. The gerundial construction takes 'planes' as patient, whereas the second reading replaces the gerund 'flying' by the (present participle) 'flying' in an attributive construction. The syntactic ambiguity operates on the borderline between *verbal* vs. *nominal* constructions.

f. *shoot* (argument$_1$, argument$_2$)

If we call the arguments:
1. agent (author, cause)
2. patient (affected, caused)

we can say that in the first reading 'the hunters' are *agent*, in the second reading they are *patient*.

g. *amare*: 'God' is agent or patient

h. *amare*: 'Clodia' is agent or patient
'Catullus' is agent or patient

i. *manger*: 'les enfants' is agent or patient/object

We have to consider some basic psycholinguistic facts:

Psycholinguistic facts:

It is clear that the notion of cause (effect) and of agency (action) are important for the examples (f) to (i) above. A psychological analogue is the concept of 'phenomenal causality' analysed by Michotte (1954). Figure 12 shows a typical configuration in Michotte's experiment.

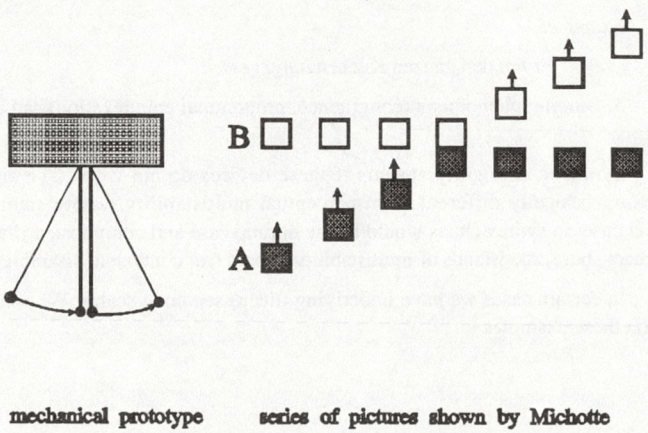

Fig. 12 *The moving squares in Michotte's experiment and a mechanical analogue*

The main features which give rise to'phenomenal causality' are:

• the objects A and B must be seen as distinct figures not as parts of a whole,

• object A must be dominant in relation to object B; i.e. the behaviour of B must be somehow dependent on the behaviour of A but not vice versa,

• there must be variability, change in the situation perceived.

Ertel (1975, 100f.) argues that these criteria can explain restrictions on passivization. If we take a process which by nature is rather symmetric, we can obtain different perspectives on it by different weights of phenomenal causality associated with the protagonists of the scene (P = prince, C = Cinderella).

Table 4 *Different weights on the scale of phenomenal causality*

Transition (a) to (d)	weight(P)	weight(C)
a. Cinderella was married by the prince.	3	0
b. The prince married Cinderella.	**2**	**1**
c. Cinderella married the prince.	**1**	**2**
d. The prince was married by Cinderella	0	3

The dominance shift happens between stages (b) and (c), whereas (a) reinforces the asymmetry of (b), (d) reinforces the asymmetry in (c). Moreover, the sentences (a) and (d) allow for the elimination of the by-phrase, i.e. of 'the prince' in (a) and of 'Cinderella' in (d). The passive sentences can, therefore, be called pseudo-transitive. These facts allow for the acceptance of a (continuous) scale which connects both arguments in a transitive sentence.

With the semantic scale as a background we can now explain the semantic ambiguities (f) to (i) as special types of multistability similar to perceptual multistability.

f+g. The ambiguities in (f) and (g) are due to the loss of information about what type of argument 'hunters' (f) and 'Deus' (g) have in genitive constructions; whereas the ambiguities in (h) and (i) are due to the embedding of a clause into a syntactically dominant construction.

h. The construction in Latin called 'accusativus cum infinitivo', which is associated with verbs of saying ('verba dicendi') and others, transforms the subject of the embedded clause into an accusative, whereby the arguments of the verb 'amare' become indistinguishable (word order is free in Latin).

i. The causative construction with 'faire' introduces a dominant cause (author, agent). The verb 'manger' is already pseudo-transitive in the active clause since the object can be left unspecified:

• les enfants mangent (-) (the children eat)

• les enfants mangent un gâteau (the children eat a cake)

The embedded clause 'manger les enfants' in reading 2 behaves like a passive clause insofar as the agent can be left open. Thus two possibilities can be chosen:

1. The agent in the embedded sentence, which is semantically under the control of the agent of the causative construction 'Jean', is left unspecified. In this case 'children' are the patients of the verb 'manger'; the children are eaten.

2. The object of the embedded clause (the food) is left unspecified (as 'manger' is pseudo-transitive); in this case the children are the subject of the embedded clause, they eat (something).

3.7. Textual ambiguities

If syntactic ambiguities are already difficult to control, one would imagine that this tendency grows in the case of texts. Contrary to such an expectation ambiguity in texts was not even viewed as a relevant phenomenon by linguists. In the field of gestalt psychology an experimental analysis of ambiguous texts was proposed by Poppelreuter as early as 1912; Metzger (1982) expanded this proposal. In Stadler and Wildgen (1987, 106-117) these materials were reassessed. Some major results will be reported here.

In the first experiment (by Poppelreuter) two texts with different protagonists and antagonists are mixed. The two lines of the plot can be easily separated by the hearer, if he recognises the two coherent thematic lines. The formal incoherences (e.g. pronouns do not fit the before mentioned nouns, etc.) help to cut up the two stories. Most of the persons tested could easily separate the texts.

In the second experiment (conducted by Metzger) the protagonists and antagonists are the same but the basic motivations and actions, and the helpers are different. Again local incoherences may help to separate the two plots. In retelling the story most of the hearers follow one of three strategies:

- they produce another rather incoherent story,

- they reorganise the story towards a coherent plot (which is rather independent of the plot in the original story),

- they eliminate all the elements of one of the underlying plots and thus disambiguate the mixed plot.

If textual ambiguity is of the type proposed by Poppelreuter and Metzger (many other types could be imagined) the ambiguity of textual meaning is defined by the existence of two (or more) consistent plots. The hearer has to find one or both of the plots. The situation is similar to a linear puzzle: one must assemble the pieces in order to regroup them into two different lines. The points of contact are defined by thematic cohesion and syntactic coherence.

Although the textual gestalt may be a very complicated object (e.g. the gestalt of a novel) it has in its kernel a linear plot or several plots interlaced around a thread. A text is ambiguous if two different plots can be associated with the text. This corresponds to the bistability of a Necker cube.

A text may also be ambiguous in a different sense if it either has a stable plot or is thematically chaotic. This corresponds to the problem of texture discrimination dealt with by Julesz. Both types of textual ambiguity can be called global as they refer to the 'gestalt' of the whole text.

A text may have many local multistabilities, e.g. a neutral observer or a secondary person can turn out to be the central protagonist or antagonist, a line which seems to lead towards a resolution can turn out to contribute to the complication, a climax can turn out to be a secondary event; in fairy tales metamorphoses of central persons can happen, they take on different forms and characters (a man/a wolf) in different episodes of the tale. Nevertheless, and this is our central hypothesis, the basic dynamics remain similar throughout the whole domain of linguistic cognition and they are rooted in perceptual/motor and emotional multistability.

We can conclude:

1. Semantic ambiguity very often has an underlying (linear) scale which is cognitively continuous. The qualities appearing on these scales are related either to perception or to emotion. This holds specifically for lexical ambiguities.

2. Syntactic ambiguities are of another kind, as their background is the instability of syntactic productivity. Ambiguities appear as 'holes' in stabilizing filters. Some of the mechanisms for the delimitation of syntactic chaos are related to low-dimensional semantic spaces (e.g. to linear scales). Although the underlying qualities are more abstract, the organization of these ambiguities corresponds to that of perceptual multistability.

In further research the models for describing perceptual multistability (catastrophe theory, synergetics, chaos theory, etc.) should be applied to semantic ambiguity, if the assumption of a low-dimensional semantic space is plausible.

4. Conclusions

Realistic semantics as defined in the first sections of this contribution allows us to reanalyse many basic problems such as the valency of verbs, sentence frames, scenarios, etc. In the present context we preferred to show that it opens a large new field, as it allows a straightforward description of multistability in meaning. At the end of Chapter 3 we pointed to chaos in linguistic meaning and its constitutive role in the organization of grammar. This radically new view of syntax is one of the most astonishing perspectives of the new paradigm in semantics. We could not go into the details, but we can already put forward the prognostic that theoretical syntax as it was developed in the last fifty years will be fundamentally challenged by this new perspective.

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