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SOME SEMANTIC UNIVERSALS OF GERMAN ADJECTIVALS

1. INTRODUCTION

1.1. The structure of natural languages as studied by linguists is connected in several ways with phenomena outside this domain. Problems of this kind are, to mention only three:

(a) the acoustical and physiological interpretation of the primitive elements in which the sound structure is represented;

(b) the conceptual or referential interpretation of the primitive elements that build up the meanings of the utterances;

(c) the structural relationships that go beyond the single sentences, usually taken as the largest units to be analyzed linguistically, i.e., the question as to the conditions that two or more sentences must meet in order to form a connected text. (This problem is not to be confused with the conditions for actually using a sentence, i.e., speech performance.[1])

Only the first of these topics has been studied to a certain extent; very little is known about the last two. In the following we will be concerned with the second problem, viz. the relationship between language structure and certain aspects of concept formation or structure of thought, as it were. This problem is in a certain sense parallel to the first one: it demands an interpretation and motivation of the primitive terms that enter into the description of given languages.

1.2. It is generally agreed among linguists that the meanings of words or morphemes are not unanalyzable wholes, but are composed of smaller elements, the minimal content units of Hjelmslev or the semantic markers of Fodor and Katz. These elements are the primes to be used in systematic descriptions of the semantic structure of natural languages. Now it has turned out in the study of sound structure that there are good reasons to assume a universal stock of primitive elements, called phonetic features, from which the particular inventories used in the description of particular languages are drawn.[2] It seems, therefore, reasonable to ask whether the in-

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[1] For a somewhat more detailed discussion of these problems see Bierwisch, 'Aufgaben und Form der Grammatik', to appear in *II. Internationales Symposium 'Zeichen und System der Sprache'*, Berlin 1966.

[2] For details see Jakobson, Fant, Halle, *Preliminaries to Speech Analysis*, MIT-Press, Cambridge, Mass., 1951.

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ventories of primitive semantic elements of different languages are to be selected in a similar fashion from a universal set of semantic primes. This is what is presupposed by Fodor and Katz; they assume that it is possible to "construct a metatheory which contains an enumeration of the semantic markers from which the theoretical vocabulary of each particular semantic theory is drawn".[3] This does not mean, of course, that the dictionary of each given language must show exactly the same distinctions as that of any other language. It implies only that, if a distinction is made, this property can be characterized in a nontrivial way in terms of the universal set of semantic markers. If we accept this view, then two different questions immediately arise:

(1) What is the theoretical status of the universal semantic markers; how must they be interpreted?
(2) What are the elements of the universal set and how can they be established?

It is obvious that the answer to (2) depends in part on the answer to (1). Note that (1) does not concern the state of the elements within the semantic theory of a particular language or even within the general scheme of such a theory. In both they are simply primitive formal elements. The question here is: in what way, by what type of phenomena, are they motivated outside the structure of language in the narrower sense? In other words: what is the interpretation of the semantic markers, how are they connected with thought?

1.3. A widespread view on this problem is that semantic properties are to be stated in terms of classes of objects or conditions of the surrounding universe, including abstract relations, general structures of the world, and so on. These properties are to a large extent the subject matter of different sciences, such as physics, biology, social sciences. With this in mind Bloomfield writes: "In practice, we define the meaning of a linguistic form, wherever we can, in terms of some other science."[4] Bloomfield's conclusion that we can give a full account of the meaning of natural languages only if we have a total knowledge of the universe represents a very extreme position in this matter. But it shares with less extreme views the assumption that each distinction made in the meanings of a given language, i.e., each semantic marker, is connected with certain classes of objects, types of relations, or properties of the universe which the speakers of that language inhabit. What one has to learn in the course of language acquisition are just these distinguished classes and relations, and the forms by means of which they are

[3] Fodor and Katz, 'The Structure of a Semantic Theory', *Language* 39 (1963) 208.
[4] Bloomfield, *Language*, New York 1933, p. 516–7.

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referred to. It is obvious that within this conception the semantic markers happen to be universal only because different speech communities live in the same universe, and only to the extent that their cultural environment is alike. To learn a new language then forces one to learn not only new lexical items, new syntactic and phonological rules, but also new semantic markers. [5]

It is very well known that the identification of semantic features of language with classes of objects and properties of the world, more or less explicitly stated in the conception just sketched, leads to many complications. Not only is there no reasonable explication of how the semantic markers are learned. It is also very difficult to explain in a natural way such well known facts as *displaced speech, fictitious objects* and in general all gaps between meaning and reality.

All these difficulties can be avoided, much more insight in the structure of language can be achieved, if we give up this misleading view and take a quite different position.

There are good reasons to believe that the semantic markers in an adequate description of a natural language do not represent properties of the surrounding world in the broadest sense, but rather certain deep seated, innate properties of the human organism and the perceptual apparatus, properties which determine the way in which the universe is conceived, adapted, and worked on. Or as Postal puts it: "Each of these primitives [of the semantic theory – M.B.] bears a fixed relation to the universe which is determined by the biological structure of the organism. Thus the relation between the semantic primitives and their combinations which are part of the combinatorial structure of language and the world is not learned but innate. What must be learned is only the relations between fixed sets of semantic primitives and sets of phonological and syntactic properties. Learning the meanings of forms (by child or foreigner) is thus a process of using contextual information and perhaps other knowledge and experience to determine which of the priorly known semantic primitives are associated with the dictionary entries of the forms in question. Naturally under this conception one would expect to find just exactly the lack of direct relation between the meanings of forms and the observable contexts of their utterance or perception or between meanings and the accompanying observable be-

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[5] In this respect there is no real difference between the views just discussed and those of Whorf, Weisgerber and others who believe that the apperception of the world depends on the internalized language. Here too learning a new language involves learning new basic components of meaning, and these components are also interpreted in terms of the surrounding universe. The universality of these primitive elements appears to be much more unlikely than that of the semantic primitives in the theories discussed above.

havior of speakers or listeners which obtains in every known language."[6]
Notice that the idea of innate basic elements of the semantic structure does
not entail a biological determination of concepts or meanings in a given
language, but only of their ultimate components. These components can be
combined rather freely and differently in different languages. It is always
possible to grasp new concepts while learning a new language and even within
one language. But to learn a new concept means then to learn a new con-
figuration of potentially known primitive elements. Furthermore, the uni-
versality of semantic markers does not mean that all markers are part of the
structure of every language but only that it has a general interpretation if it
should appear in a certain language.

If this view is acceptable, and it seems to me that it is, then the universality
of semantic markers is not a theoretical accident but rather a constitutive
fact of human speech, of the capacity that de Saussure called *langage*. And
on the basis of this view a very revealing answer to our question (1) can be
developed. Of course, almost nothing is known at the moment about the
structure of this apparatus of primitive conceptual elements and its relation
to the real world. But it seems possible to make the first steps towards in-
vestigating these postulated elements.[7] In this sense I will analyze some
features pertinent to a group of German adjectives. This will lead us to some
preliminary conclusions and we will then come back to the second question
raised above.

2. POLARITY OF GERMAN ADJECTIVES

2.1. The presupposed syntactic framework of the following considerations
is a generative grammar of German. But we can restrict our attention to some
very simple sentence types and we will be concerned only with abstract deep
structures.[8] Furthermore it is necessary to keep in mind that a semantic de-
scription of some natural language must contain not only the characteri-
zation of the lexical entries, i.e., the combination of the semantic markers
within the words or morphemes, but also the rules that determine how the
meanings of larger constituents and whole sentences are constructed out of

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[6] Postal, Review Article of André Martinet, *Elements of General Linguistics*, in *Foundations of Language* **2** (1966) 179.

[7] Actually the first steps have already been taken. We may cite here many of Jakobson's morphological investigations, Bech's *Grundzüge der semantischen Entwicklungsgeschichte der hochdeutschen Modalverba*, Kopenhagen 1951, Leisi's very insightful *Der Wortinhalt, seine Struktur im Deutschen und Englischen*, Heidelberg 1953, from which many of the following observations are drawn. This list could easily be extended. What remains to be done is to incorporate all these and many other observations in a general theory.

[8] For the notions of deep structure and surface structure see for instance Chomsky, *Aspects of the Theory of Syntax*, MIT-Press, Cambridge, Mass., 1965.

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the word meanings on the basis of the syntactic structure of these constituents. We will be concerned primarily with the meanings of words. But even these can be stated adequately only if they are seen as entities which enter by means of certain rules into the complex meaning of any possible syntactic configuration.[9]

The sentence types considered in the following are essentially copula sentences with *Adj(ectival)* as predicate and in some cases intransitive sentences with an *Adv(erbial)* manifested by an *Adj*. These sentences have deep phrase markers as in (3) and (4) respectively:

(3)
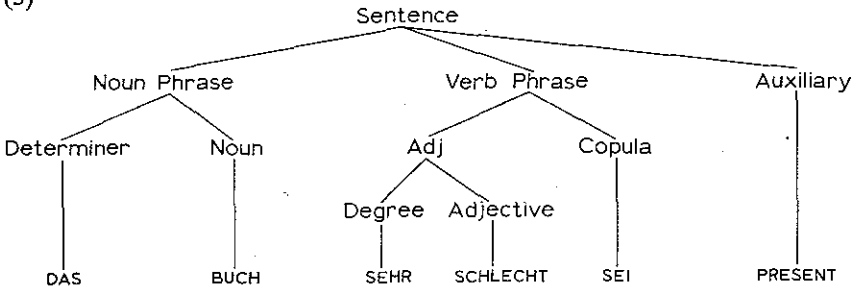
(4)
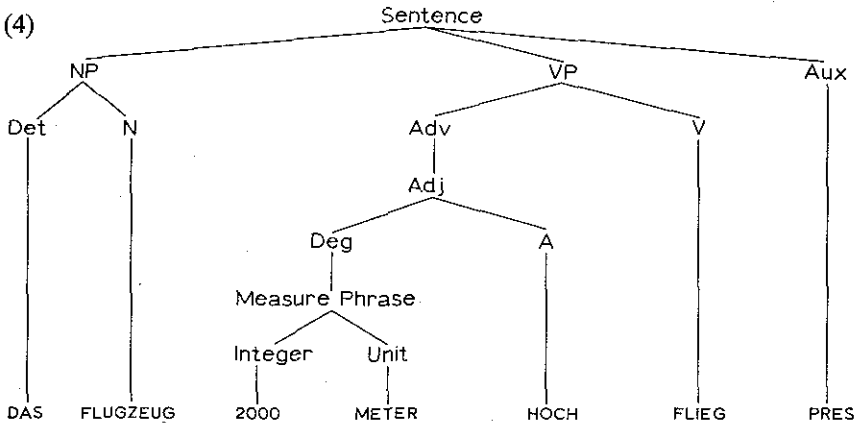
These structures are oversimplified in several respects which do not concern us here. They are ultimately mapped by transformational and morphological rules on the actual sentences (5) and (6):

(5) Das Buch ist sehr schlecht.
(6) Das Flugzeug fliegt 2000 Meter hoch.

[9] This has been stated most clearly by Fodor and Katz in 'The Structure of a Semantic Theory'. Although we will follow the principles developed there, certain modifications will be necessary. For technical details see section 4 below. Cf. also fn. 21 below.

The constituent *Deg(ree)* may contain several structures, including the comparative morpheme ER plus a suitable sentence as in *Ein Auto fährt langsamer als ein Flugzeug fliegt*, elements like *zu* and *genug* as in *Der Tisch ist zu klein für diesen Zweck*, etc.[10] Certain context restrictions on the appearance of *Deg* are necessary. Some aspects of these restrictions we will touch on later. Roughly then an *Adj* in German is a constituent containing an adjective possibly modified by certain types of *Deg* and modifying in turn either the subject of a copula type sentence (the head of a *NP* in appropriate derived structures) or the main verb. This is a simplification, useful only for the present purpose.

2.2. Consider now the following list of German adjectives:

(7)　A: lang weit weit breit　　hoch　tief　dick dick　　gross
　　　B: kurz nah eng schmal niedrig flach dünn schlank klein

　　　A: alt alt　　schnell　lang früh
　　　B: neu jung langsam kurz spät

　　　A: gut gut　　　schön　　groß schwer schwierig stark
　　　B: böse schlecht häßlich klein leicht　leicht　　schwach

　　　A: laut hoch hell
　　　B: leise tief　dunkel

In this list the items are arranged in pairs due to the already known fact that "polarity" plays an important role in the structure of adjectives.[11] The set of pairs can easily be extended, and a lot of "derived" adjectives receive their counterpart by the prefix *un* as in *königlich – unköniglich, amerikanisch – unamerikanisch*, etc. Some adjectives have more than one counterpart, corresponding to different meanings.[12] Of course, not all adjectives are structured in this way, the most important exception being the color words.[13] In a

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[10] A detailed discussion of different expansions of Deg (= Grad) is to be found in Motsch, *Syntax des deutschen Adjektivs* (Studia Grammatica, III), Berlin 1963. An analysis of the Measure Phrase in English which applies almost without modification also to German is to be found in a mimeographed paper by J. R. Ross.

[11] Cf. for instance Leisi, *op. cit.*, and Brinkmann, *Die Deutsche Sprache*, Düsseldorf 1962, p. 123–30.

[12] Actually the situation is somewhat more complicated. In some cases different counterparts may correspond to different meanings, as in *hoch* vs. *niedrig* and *hoch* vs. *tief* (of pitch). In other cases an adjective may be simply indifferent as to the different features of its counterparts. Possibly *alt* has not two different meanings which correspond to *neu* and *jung*. Cf. section 5.2 below.

[13] The lack of polarity is by no means a superficial fact. It is very well known that color words are learned by the child far later than pairs as *groß* and *klein*, etc. This may be the case also for other nonpolar words such as *nackt*, *taub*, etc. Polarity then is basic in more than one sense.

semantic theory of German this polarity has to be described in such a way that the following paraphrases follow automatically:

(8) (a) Die Mauer ist zu hoch, – Die Mauer ist nicht niedrig genug.
    (b) Die Mauer ist nicht zu hoch. – Die Mauer ist niedrig genug.

We can generalize this observation easily in the following manner, using A and B as variables over all corresponding entities headed by these letters in the list (7):

(9) Sentences of the following form are pairwise paraphrases:

$$\text{(a)} \quad X \begin{bmatrix} \text{zu} \\ \text{genug} \end{bmatrix} A \text{ für } Y - X \text{ nicht} \begin{bmatrix} \text{genug} \\ \text{zu} \end{bmatrix} B \text{ für } Y$$

$$\text{(b)} \quad X \text{ nicht} \begin{bmatrix} \text{zu} \\ \text{genug} \end{bmatrix} A \text{ für } Y - X \begin{bmatrix} \text{genug} \\ \text{zu} \end{bmatrix} B \text{ für } Y$$

This statement applies to copula sentences as well as others. X and Y are variables over arbitrary strings. The element *genug* will be shifted ultimately behind the adjective. A formal explanation of (9) demands a general account of negation, for example, in the manner of Katz[14], a characterization of the antonyms *zu* and *genug*, and a suitable analysis of the sets A and B of adjectives. As to *zu* and *genug* we would say informally that they have to contain two antonymous markers which can be paraphrased roughly as "exceeding a certain norm" and "meeting a certain norm" respectively. What this norm actually is, is not shown by the isolated items, but is specified by the following adjective. So *zu* and *genug* are instances of so called syncategorematic elements, i.e., they have no autonomous meaning when isolated. Turning now to the adjectives involved, we analyze each entry of (7) into a marker expressing the polarization, which we will represent as $(+\text{Pol})$ and $(-\text{Pol})$, and a remainder R which in turn consists of a set of markers that will be left unspecified for the moment. We just note that in general R is identical for each two adjectives that are paired in (7). So we have this preliminary analysis:

(10) lang $(+\text{Pol})$ R1, weit $(+\text{Pol})$ R2, weit $(+\text{Pol})$ R3
     kurz $(-\text{Pol})$ R1, nah $(-\text{Pol})$ R2, eng $(-\text{Pol})$ R3, etc.

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[14] See for instance Katz, *The Philosophy of Language*, New York 1966, p. 201. It must be noted, that this account of negation must be modified, since it is based on the assumption that the meaning of words and larger expressions consists of unstructured sets of markers, which is clearly inadequate. But we cannot go into details here.

The $(+ \text{Pol})$ and $(- \text{Pol})$ markers then are the defining properties of the sets A and B respectively.[15]

2.3. Up to this point it is immaterial which one of two polar adjectives is assigned to the set A and which one to B: If our assumed rules yield the desired paraphrase-relation (9) for *lang* and *kurz* by means of the analysis given in (10), then they will yield the same result if we had $(- \text{Pol})$ R1 for *lang* and $(+ \text{Pol})$ R1 for *kurz*. The only necessary condition is that *lang* and *kurz* as well as the elements of other pairs have antonymous (Pol)-markers. Further observations show, however, that this condition is insufficient, i.e., that $(+ \text{Pol})$-assignment is not arbitrary. Consider the following normal and odd sentences:

(11) (a) Der Tisch ist doppelt so lang wie die Bank.
      (b) Das Auto fährt halb so schnell wie die Eisenbahn.
      (c) Sein Bruder ist halb so alt wie er.
(12) (a) *Der Tisch ist halb so kurz wie die Bank.
      (b) *Das Auto fährt doppelt so langsam wie die Eisenbahn.
      (c) *Sein Bruder ist doppelt so jung wie er.

The sentences in (12) are at least much more difficult to grasp than those in (11), and there is good reason to mark them as deviant. This assumption requires some comment. Although (13) is odd in the same sense as (12), it sounds quite acceptable if for instance we presuppose a request for thread as fine as possible:

(13) Der Faden ist doppelt so dünn wie ein Haar.

Without some such condition we would have to mark (13) as deviant. We can generalize this statement for further purposes to the following principle:

(14) A sentence is the less normal the more conditions outside of it have to be met for it to be acceptable.

This principle applies to a wide range of facts, and will be especially useful for estimating many of the problematic semantic data. It is, of course, a heuristic principle only, which does not belong to the theory proper, but I would assume that some version of this principle will find a strict and formal reconstruction even within general linguistic theory.

If we then take the deviancy of (12) for granted, it follows that both directions of polarity are not equivalent in each respect. We will analyze those adjectives for which the *Deg* may be expanded into *doppelt so, halb so, zehnmal so*, etc., into $(+ \text{Pol})$R. In this way we come to something like an "orien-

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[15] $(+ \text{Pol})$ and $(- \text{Pol})$ turn out to be a generalization of the markers $(+)$ and $(-)$, that Katz postulates for the analysis of *good*. See his *The Philosophy of Language*, pp. 289–317. Cf. also fn. 28 below. For a certain reservation see section 2.5 below.

tation" of the polarity. But notice that this orientation does not hold for all pairs of adjectives, i.e., not for all the remainders R. The following pairs of sentences are equally acceptable to me:

(15) (a) Peter spielt doppelt so gut wie Klaus.
     (b) Peter spielt halb so schlecht wie Klaus.
(16) (a) Im Zimmer ist es halb so dunkel wie im Korridor.
     (b) Im Zimmer ist es doppelt so hell wie im Korridor.

So we are led to two subsets of pairs of adjectives: Those for which (+Pol) marks an orientation and those for which it does not. Within the oriented set there is a further subset that can be modified by $M(easure)\,P(hrase)$. Here the orientation is much more clearly distinguished. We have only the sentences:

(17) (a) Der Zug ist 10 Wagen lang.
     (b) Der Fluß ist 250 Meter breit.
     (c) Die Maschine fliegt 2000 Meter hoch.
     (d) Achim ist 35 Jahre alt.

The following sentences are indisputably odd:

(18) (a) *Der Zug ist zwei Wagen kurz.
     (b) *Der Bach ist einen Meter schmal.
     (c) *Die Maschine fliegt 100 Meter niedrig.
     (d) *Katharina ist zwei Jahre jung.

Only the (+Pol) marked elements of an antonymous pair of adjectives can take an *MP*, and in this case the whole Adjectival does not indicate one of the poles involved, but only the scale which is established by the pair and a certain point within this scale. The orientation can be taken as "neutralized". We can account for this semantic fact, if we formulate the rules for amalgamating *MP* with the adjective so that the semantic characterization of *MP* replaces the (+Pol)-marker in A.[16]

[16] Fillmore in an article 'Entailment Rules in a Semantic Theory', *POLA Reports* **10**, Ohio State University 1965, has proposed an analysis of such adjectives as *tall, old*, etc., which takes the comparative construction as basic and interprets the adjectives as relational elements. Fillmore writes: "The theory will initially assign a relational meaning to words like 'tall'. (Notice, however, that a sense relating only to the dimension "height" will also be needed for 'tall' – but nor for 'short' – as is seen in the way we understand such expressions as 'six inches tall' or 'this tall'.)... In those cases where the sentence does not contain a second term for the relation, the semantic theory will provide one, say the word 'average'." Certainly Fillmore is right with respect to the relational character of such items as *tall, groß, lang* etc., if (+ Pol) is not substituted by the content of an *MP*. But an explicit representation of this fact requires at least the introduction of relational markers in the semantic theory. Although this is necessary for several independent reasons, their formal specification would go far beyond the limitations of the present article. Therefore we leave the relational character of the adjectives formally unexpressed, accounting for their relation to a given norm or presupposed average only by the interpretation of the (Pol)-markers in section 2.4 below.

2.4. We have discussed only the formal aspects of certain meaning properties of adjectives, our motivation for establishing (+Pol) and (−Pol) was purely linguistic. We can now look for the interpretative aspect. What facts are represented by our formal markers? If we hear the sentence *Der Raum ist hoch*, then we know that something about a certain dimension of a room is said, but we do not know how large is that dimension, not even roughly. But if we hear *Das Zimmer ist hoch*, then we know that the vertical dimension of the room is at least about three meters. It may be larger by an uncertain but limited amount, if we hear *Das Zimmer ist sehr hoch*. Similar considerations hold for *Der Raum ist niedrig* and *Das Zimmer ist sehr niedrig*. This last sentence may refer to the same situation as the sentence *Das Zimmer ist nur 1,85 Meter hoch*. The conclusion is obvious. The remainder R establishes a certain scale, and (+Pol) and (−Pol) may fix a certain point within this scale only with respect to a certain norm. No such norm is contained in the sentences with *Raum*, but it is given with *Zimmer*.[17] The norm is irrelevant, if an *MP* appears, and here the (Pol)-marker is erased from the semantic representation. This solves the often raised problem, whether *jung* and *alt* and many other pairs have "discrete" meanings. The question "up to which time is a man young, from what age on is he said to be old" is simply a pseudoquestion. If one does not know the normal life span of a Saurian, then one does not know how many years are implied by the sentence *Der Saurier war alt*, but one can very well understand the full meaning of the sentence, namely that the Saurian referred to has lived nearly all of his normal life. And for the meaning of *alt* it is quite immaterial whether the number of years implied in *Der Elephant war sehr alt* is smaller than in the previous example or not.

From these considerations we may draw two important conclusions. Firstly the norm to which the poles of a scale are related may be represented in the semantic structure – as in *Zimmer*, or may not be so represented – as in *Raum*. In many cases the "objective correlate" of the norm does not belong to the language structure at all, and it may very well be the case that in all instances where the norm does become a feature of the linguistic structure, this norm may be directly or indirectly derived from the human organism. Secondly it is clear that the norm itself does not belong to the meaning of the adjectives discussed so far, even if the norm is represented by semantic markers. The adjectives are, therefore, syncategorematic in their meanings. What the adjectives express themselves is only the fact that a certain norm

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[17] Since the semantic theory has to characterize *Zimmer* as a room for human beings to live in, its size depends on the human body. So the (− Pol) may refer to about 1,80 m. This is only a very vague paraphrase of the facts not further to be discussed here.

is implied. The as yet unanalyzed remainder R establishes the scale to which the norm is related, and the (Pol)-markers give the type of relation to the norm. Thus we may say that adjectives do not express norms, but normativity. Now this normativity is likely to be a general feature of the apperceptive structure of organisms. In many cases we may be completely unable to find any objective measure for a certain norm, as long as we do not take into account the structure of the organism interacting with the objective world. This normativity of the human organism we have found already in connection with *zu* and *genug,* and we will find it below in several other respects.

2.5. There are two further problems to be discussed. We have specified so far two subsets of pairs within the whole set of polarized adjectives: those for which the distribution of (+Pol) in the correlated pairs has linguistic effects, as in *lang/kurz* vs. *hell/dunkel,* and then within this subset those pairs for which the (+Pol)-carrier may be modified by *MP.* Now the question arises whether these subsets may be characterized by further semantic markers, say (Orientation) for the first set, and (Orientation) (Measurable) for the second subset. In this case the features (+Pol) (Measurable) will qualify as context restriction for the appearence of *MP.* An interpretation of such markers seems to be reasonable within our presupposed framework. But another treatment may be more revealing. Notice, first, that for all measurable adjectives the orientation is an automatic consequence of the rule for substituting the reading of *MP* for (+Pol). More generally: for measurable adjectives the (+Pol) is that of the increasing number of units. We have, e.g., *schnell* and *alt* both marked (+Pol), though the first indicates *short time,* the second *long time,* roughly speaking. If we now assume that certain markers in R are the condition for an *MP* to modify an adjective, then the properties represented by (Orientation) and (Measurable) are a direct effect of the structure of R, namely of the markers presupposed by *MP.* Similar considerations may hold for the orientation in nonmeasurable adjectives. A decision in this respect requires further investigation not only of German adjectives, but also of related facts in other languages.

Note by the way that measurability does not depend on any scientific system of measure or on our scientific knowledge of the world. On the one hand we have unscientific measurements such as *Das Haus ist zehn Fenster breit, Die Grube ist drei Klafter tief.* On the other hand there are well defined units in physics for certain scales, but the corresponding adjectives remain unmeasurable, such as *hell* or *hoch* with respect to sound.[18]

[18] A more complete treatment would distinguish between relative and absolute measurement, because we have such sentences as *Peter singt drei Töne höher als Klaus,* but not *Peter singt drei Töne hoch.* Our discussion pertains only to absolute measurement.

The second problem concerns the type of relation with respect to the given norm that (+ Pol) and (− Pol) are meant to represent. There are two rather different placements of the norm with respect to the scale indicated by R, for which *lang/kurz* and *gut/schlecht* may serve as examples. *Die Zigarette ist lang* means that the cigarette is longer than the presupposed average, *Die Zigarette ist kurz* means it is shorter than the expected average. *lang* and *kurz* are connected with the same scale, the extension of which may be established by the modified noun, in our examples by the possible length of different cigarettes. Within that normalized scale there is a point indicating the expected average. Now (+ Pol) and (− Pol) indicate that the modified objects are placed at the one or the other half (or end) of the scale relative to the average point. That means they are in a certain sense inverse relations with the average as one of its terms, the extension of the object in question as the other. The situation is quite different for *gut/schlecht*, as Mrs. Anna Wirzbicka has brought to my attention. *Die Zigarette ist gut* does not mean that the cigarette is better than the average, but that it fits the expected standard, just as *Die Zigarette ist schlecht* does not mean it is less good than the average, but that it does not fit the standard. What is going on here may be paraphrased as follows: The scale established by such pairs as *gut/schlecht, schön/häßlich, gesund/krank* is not divided into two parts by the average point, but the norm is one of its end points. (+ Pol) here means: meeting this norm (or near to it), (− Pol) means: missing the norm (or far from it). Here too a relation between the norm and the object in question is represented by (+ Pol) and (− Pol), but they are not inverse in the same sense as they are for *lang/kurz*.

So we have two classes of adjectives: one for which the normalization point around which the scale is arranged lies within the scale, and one for which it is one of its ends. These classes are not coextensive with that established by the possibility of absolute measurement. *hell* for instance cannot take an *MP*, but it belongs to the *lang/kurz*-class. But it seems to be that only for adjectives with the average within the scale relative measurement in the sense of fn. 18 is possible.

One may ask now whether a precise, formal representation of the relational character of the (Pol-)markers would split up these markers into two different pairs representing different relations with respect to the normalization. Here again it seems possible that the type of norm-relation is predictable from the formal structure of R, so that one general pair of (Pol)-markers is sufficient. But we need not decide that, because our further discussion pertains only to the *lang/kurz*-type of norm-relation.

3. SPATIAL STRUCTURE OF GERMAN ADJECTIVES

3.1. We will turn now to the analysis of R. We already noted that R marks the scale for which (Pol) fixes a certain value or which is specified by the substituted markers of *MP*. In the latter case a specific unit of the measure appears in the Adjectival. For a certain subset of adjectives this unit characterizes length and may (but need not) be identical. These are *lang, weit, hoch, breit, tief, dick,* and *groß*. To this group, together with their corresponding (−Pol)-elements, we will now restrict our attention.

All these adjectives are related somehow to the dimensions of space, at least as long as the modified nouns are physical objects. And the following discussion will be restricted to this class of cases. Since all physical objects have three dimensions orthogonal to each other – which is, of course, a consequence of the human perceptual apparatus, not a property of the universe as such – one could think of three markers (1 Dim), (2 Dim), and (3 Dim), characterizing *lang, breit,* and *hoch* as follows:

(19) lang (+Pol) (1 Dim)
        breit (+Pol) (2 Dim)
        hoch (+Pol) (3 Dim)

Different combinations and further qualifications would be needed, of course, for the other spatial adjectives. Some reflection will show, however, that this abstract geometrical analysis is insufficient as a basis for the semantic structure of natural languages. Although the three orthogonal dimensions organize spatial experience of human beings, they are not symmetrical, or regarded as equivalent, as in geometry. Most importantly, there is a deep-seated difference between the vertical dimension and the horizontal ones. This difference is psychologically well attested and concerns both practice *and* perception. As we will see later, it must be represented in the semantic structure on purely linguistic grounds. We could do that by postulating a marker for verticality, which is (+Vert) for the vertical dimension and (−Vert) for the others. These in turn may be differentiated by a marker, that specifies the secondary dimension as opposed to the primary one. So we arrive at the tentative analysis (20), which replaces (19).

(20) lang (+Pol) (−Vert) (−Second)
        breit (+Pol) (−Vert) (+Second)
        hoch (+Pol) (+Vert)

These markers are not postulated ad hoc, they are needed elsewhere. (+ Second), for instance, must enter the semantic description of *quer, Seite* in

one of its meanings, perhaps *rechts* and *links*, etc. (−Second), is needed, i.a., for the preposition *längs*. (+Vert) of course characterizes elements such as *oben, unten, über, unter*, but also the verbs *steigen, fallen, heben, senken*, and others. Most interesting in this connection are the verbs *stellen* and *legen*, both meaning "to put". *stellen* indicates a placement with respect to the (+Vert)-axis of an object, *legen* with respect to a (−Vert)-axis, marked in the object. Thus we have:

(21) (a) Er legte das Tuch auf den Tisch.
    (b) *Er stellte das Tuch auf den Tisch.
    (c) *Er legte den Topf auf den Tisch.
    (d) Er stellte den Topf auf den Tisch.
    (e) Er legte das Buch ins Regal.
    (f) Er stellte das Buch ins Regal.

Because a book can be placed both according to its (−Vert) and (+Vert)-axis, (21)(e) and (f) are equally normal. And since a cloth normally can be put only according to (−Vert)-axis and a pot only in its (+Vert)-axis, (21)(b) and (c) are deviant.

Nevertheless, the semantic structure even of *lang, breit*, and *hoch* is much more complicated than the analysis (20) suggests. Some further observations will make that clear. Consider the following normal and deviant sentences:

(22) (a) Der Wagen ist lang.   Der Wagen ist hoch.
    (b) Die Stange ist lang.   Die Stange ist hoch.
    (c) Die Zigarette ist lang.   *Die Zigarette ist hoch.
    (d) *Der Turm ist lang.   Der Turm ist hoch.

Wagen and *Stange* can be modified both by *lang* and *hoch*, but in the case of *Wagen* the two adjectives refer to different dimensions, whereas in the case of *Stange* the same dimension of the object is marked as (+Pol), the difference being only, that the pole modified by *hoch* is conceived as vertical, while nothing is said about verticality by the use of *lang*. This difference then is not inherent in the noun, but must be induced by the adjective. For *Zigarette* and *Turm*, on the other hand, only one of the two adjectives can normally be used, depending on their verticality or non-verticality. It follows from these facts, that the semantic structure of the adjectives in question is tied up in a rather complicated way with the structure of the modified nouns. The following scheme, where the (+Pol)-names for different dimensions of certain objects are listed, will clarify this further:

(23)

Noun	(1 Dim)	(2 Dim)	(3 Dim)
Wagen	lang ·	breit	hoch
Schrank	hoch	breit	tief
Tür	hoch	breit	dick
Brett	lang	breit	dick
Zigarette	lang	dick	
Turm	hoch	dick	
Stange	{ lang } { hoch }	dick	
Fenster	hoch	breit	——
Straße	lang	breit	——

The matter becomes yet more complicated, if *groß* is taken into account:

(24)

Noun	(1 Dim)	(2 Dim)	(3 Dim)
Wagen	groß		
Tür		groß	dick
Brett		groß	dick
Fenster		groß	——
Stange	groß	dick	
Mensch	groß	dick	

For *Stange* I am not sure, that *groß* is normally used to indicate (+Pol) for length. In other cases, the domain of *groß* is not clear without further qualification: *Der Schrank ist groß* may concern all three dimensions or only (1 Dim) and (2 Dim). *Der Tisch ist groß* seems to say nothing about its height. Ignoring these uncertainties for the moment, we observe some complementarity between *groß* and *dick*.

A further restriction in the combination of adjectives is connected with round or globular objects, such as *Teller, Topf, Ball, Apfel,* etc. With these nouns *lang* and *breit* cannot be combined, and for *Ball, Apfel,* etc., *hoch* is also ruled out. *groß* on the other hand refers to all three dimensions. This may be shown as follows:

(25)

Noun	(1 Dim)		(2 Dim)	(3 Dim)
Topf	{ hoch _____ groß _____		groß	}
Ball			{ groß } { (dick) }	

As to *Ball* the entry *dick* is given in brackets, because it strikes me somewhat deviant, whereas it is quite normal in combination with, let's say, *Apfel*.

3.2. It is obvious, that the facts adduced in (22) through (25) cannot be explained without an examination of certain features of the semantic structure of the nouns involved. It goes without saying, that we cannot give here a full account of the class of nouns in question, not even of their spatial structure. We will sketch only some aspects, that may enable us to state the properties of spatial adjectives, on the basis of which much of their behavior can be predicted.

We assume then, that each of the nouns in question is semantically organized in part according to three – or at least two, as *Fenster, Straße, Platz,* etc. – orthogonal dimensions.[19] These dimensions are specified by further markers, so that the possible combinations with adjectives follow as exemplified above. The dimensions, together with all their qualifications, are part of the spatial structure of the nouns, these in turn being part of the further specification of the feature (Physical Object), which is, besides its spatiality, characterized for instance with respect to consistency as rigid, soft, etc. The marker (Space), that we will introduce in order to account for this dimensionality, must be understood rather abstractly. (Space) represents the fact, that a large part of our experience is organized according to spatiality, of which the real three dimensional space is only one instance. Other domains of our conceptual structure, such as evaluation, importance etc., and even of our perception, as, for instance, pitch, are modeled within the same framework. And a lot of linguistic facts suggest that even time is to be understood as a one-dimensional space. Thus, if dominated by the marker (Physical Object), then (Space) represents the physical dimensions of space; if not, as for instance in *große Angst, hoher Preis, hoher Ton, lange Zeit*, then it indicates a more abstract space structure. From these considerations it is clear, that the number of dimensions is specific for each type of space. This can be represented formally by taking (Space) not as a binary feature with values "+" and "−", but as a marker with numerical value (n Space) with $n=1$ for instance in *Zeit*, $n=2$ in *Fläche* and $n=3$ in physical objects as *Wagen, Ball*, etc. If necessary, then (−Space) may indicate absence of any dimen-

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[19] There are, of course, other nouns, for which these assumptions do not hold. *Jacke, Mantel, Tüte* – to mention only three – are not organized along the three orthogonal dimensions. *Mantel*, for instance, may be modified by *lang* and *dick*, but not by *breit*, and if it is modified by *weit*, then quite another property is established. *dick* on the other hand has a different meaning if combined with, let us say, *Tür* and *Mantel*. It is ambiguous in a certain way, if used with *Tüte*, referring either to the material of which it consists or to the object as a whole. We must ignore all these facts here, hoping only, that our analysis will facilitate their further investigation.

sionality.[20] With (*n* Space) we can abandon the markers (1 Dim), (2 Dim), and (3 Dim) given in (19).

As to the markers for further specification of the different dimensions, we have already introduced (Vert) and (Second). One more marker is needed to indicate whether one axis of an object is understood with respect to a presumed observer, which is by no means necessarily the speaker or the hearer. By (+Observ) we will mark an axis, by which an object is normally related to its observer or user, which is directed to the observer or – which amounts to the same thing – away from him. (+Observ) is needed in *vorn, hinten, vor, hinter, Rücken*, etc. It can easily be seen, that this marker governs the behavior of *tief*, whereas verticality is only introduced contextually, because we have *Der Schrank ist tief* with horizontal, and *Das Meer ist tief*, with vertical (+Pol)-axis. It seems evident, that (Observ) represents an organizing feature of our understanding of the world. And it is equally evident, that it does not represent a feature of the objects as such.

The markers (+Vert) and (+Observ) share a certain property, namely the orientation of an axis not with respect to the internal structure of an object, but to its environment: orientation with respect to the observer in the case of (+Observ), and with respect to the surface of the earth in the normal case of (+Vert). This common property of (+Vert) and (+Observ) will be represented by the marker (−Inherent), indicating that the direction of an axis is not purely inherent to a given object, but depends on its normal placement with respect to its environment. The corresponding marker (+Inherent) will then represent the fact, that no relation of a given axis to the environment of the object is involved. The marker (−Inherent) establishes at the same time a zero point, if the dimension in question is measured. For (+Vert) the zero point is the bottom of a given object or distance, for (+Observ) it is the side facing the observer. This accounts for the fact that for *hoch, tief,* and *weit* a certain direction is involved for the plus pole of the scale, which is not the case for *lang, breit, dick,* and *groß*.

The conceptual interpretation of (Inherent) seems, thus, fairly clear. That its separate representation in the semantic structure turns out to be necessary, has among others the following reason. Only (−Inherent)-adjectives may be combined with a prepositional phrase like *über der Erde, vor der Stadt*, etc.,

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[20] That (1 Space), (2 Space), and (3 Space) are necessary for purely linguistic reasons, will be seen later. That all three types of dimensionality are possible within the perceptual structure of human beings seems to be fairly clear. But it may very well be, that three dimensionality is the innate upper limit for the human apperception. This would mean then, that $\max(n)=3$ is a linguistic universal. All spaces with more than three dimensions, as constructed in modern geometry, are in that case parasitic, derivative structures, which are possible on the basis of the variability of *n* in (*n* Space). But we will not speculate on this point any further.

thus forming an Adverbial. So we get (26), but only with totally different syntactic and semantic structure do we get (27):

(26) (a) Das Haus liegt weit vor der Stadt.
    (b) Das Flugzeug fliegt hoch über den Wolken.
    (c) Die Stadt lag tief unter ihm.
(27) (a) Der Tisch steht lang vor dem Fenster.
    (b) Die Wolken hingen breit über der Stadt.
   (c) Er stand groß in der Tür.

In (27) the adjectives do not enter an Adverbial, but are reduced predicates of the subject of the sentence.

Although we have already introduced the marker (Second) in order to distinguish among the non-vertical dimensions, this will not be sufficient to describe the behavior of *lang* vs. *hoch* and *breit*. From the examples in (23) it can be seen, that an object may – but need not – have a maximal axis. This axis is occupied by *hoch* if it is normally vertical, and by *lang* otherwise. But if an object is marked (+ Observ) for one of its dimensions and this dimension is not at the same time maximal, then *lang* is ruled out completely. In that case, if the vertical axis is not simultaneously the maximal one, the (+ Second)-marked dimension may be maximal. This, for instance, is the case with *Schreibtisch*. These facts can be described by a marker (+ Max) for the maximal dimension of an object, in case there is one, and (− Max) for all other dimensions. The markers (± Max) then represent an aspect of the expected proportions of an object. Although it seems natural that expected proportionality determines our conception of objects rather deeply, it is not easy to decide whether it is one of the basic features that govern our interaction with the surrounding world or not. But even if it could be further reduced to more elementary features, it seems clear to me, that something like the (± Max)-markers must enter the semantic description of spatial structure.

A last pair of markers will discriminate between main dimensions and subsidiary ones, where the latter constitute only the volume of an object, presupposing one or two main dimensions. The marker (− Main) determines the behavior of *dick*, (+ Main) indicates all dimensions involved in the use of *groß*. Although this distinction is not unplausible, it seems less cogent than the previous ones. I do not know of other semantic facts that motivate its introduction with sufficient clarity, and its psychological interpretation is far from clear. The above mentioned difficulties with *dick* (cf. fn. 19) may indicate, that something has not been correctly understood here. Perhaps another interpretation of the features will suffice, but perhaps quite a different distinction will be necessary. Nevertheless, since the behavior of *dick/dünn*

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and *klein/groß* will be predicted in terms of these markers with rather good approximation, we will go on with ($\pm$ Main), keeping in mind some reservation as to its definiteness.

3.3. Having established the necessary markers, we may now indicate how the different dimensions of nouns are to be organized, in order to explain their interaction with the spatial adjectives. Consider *Schrank* as an illustrative example, where [+ Noun] stands for all its syntactic features:
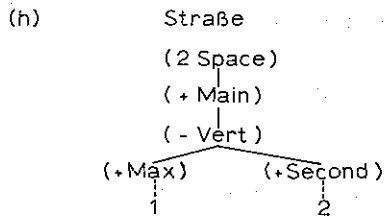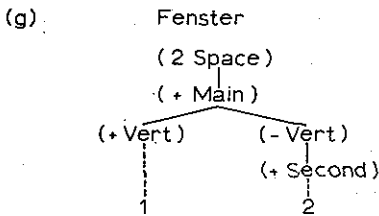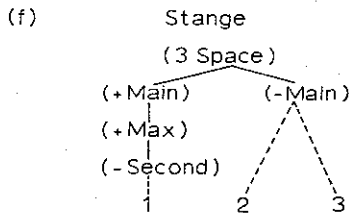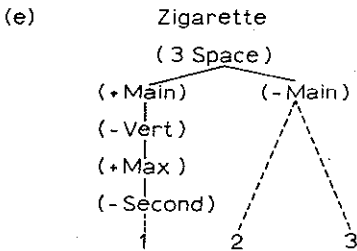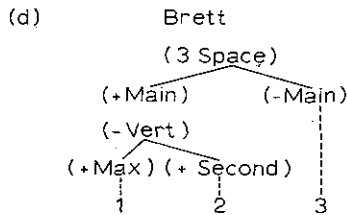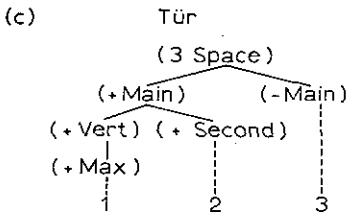
(28)
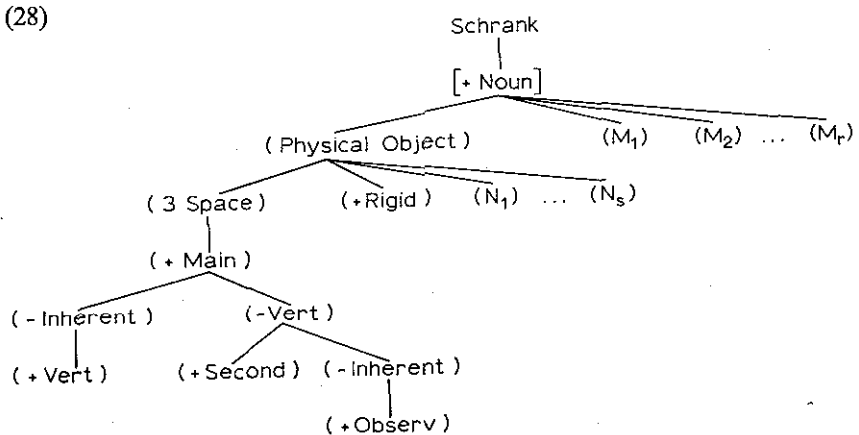
With this kind of semantic structure we change radically the concept of sense characterization proposed by Fodor and Katz. For comments and motivation of this change see section 4. For the moment it may only be noted, that branching in (28) and all the following diagrams does not mean "alternatively present", as in the famous *bachelor*-example from Fodor and Katz. All the markers of (28) – where (M_1) through (N_s) indicate further necessary specifications – are to be understood as coexistent. The tree structure indicates their relative subordination. What is formally meant by "subordination" will become somewhat clearer in section 4.

Omitting all the markers on which the behavior of spatial adjectives does not depend or which are automatically predictable, as ($-$ Inherent) for (+ Vert) and (+ Observ), we can now give the structure of certain diagnostic nouns as under (29).

The numbers at the end of the different branches are not part of the semantic structure of the given examples. They are used only by way of illustration in order to show how the dimensions are distributed on the different markers under (*n* Space). It will be seen later, that this numbering is superfluous for linguistic purposes. And as far as a distribution of the *n* dimensions, indicated

(29)

(a) Wagen
     (3 Space)
      (+ Main)
  (–Vert)   (+Vert)
(+Max) (+ Second)   ┊
   1   2   3

(b) Schrank
     (3 Space)
      (+ Main)
  (+Vert)   (–Vert)
   ┊   (+ Second)(+Observ)
   1   2   3

(c) Tür
     (3 Space)
  (+Main)   (–Main)
(+Vert) (+ Second)   ┊
 (+Max)   ┊   ┊
   1   2   3

(d) Brett
     (3 Space)
  (+Main)   (–Main)
 (–Vert)   ┊
(+Max) (+ Second) ┊
   1   2   3

(e) Zigarette
     (3 Space)
  (+Main)   (–Main)
 (–Vert)   ╱ ╲
 (+Max)   ╱   ╲
 (–Second)   ╱   ╲
   1   2   3

(f) Stange
     (3 Space)
  (+Main)   (–Main)
 (+Max)   ╱ ╲
 (–Second)   ╱   ╲
   1   2   3

(g) Fenster
     (2 Space)
      (+ Main)
  (+Vert)   (–Vert)
   ┊   (+ Second)
   1   2

(h) Straße
     (2 Space)
      (+ Main)
      (– Vert)
  (+Max)   (+Second)
   1   2
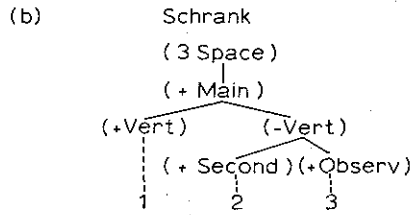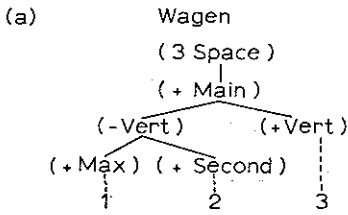
in (*n* Space), is needed, this will be governed by general rules, which say something like the following:

(30) Given a structure with the marker (*n* Space), then m dimensions belong to the m branches descending from the marker (+Main) with $m \leq n$. The remaining $n - m$ dimensions belong to the branches not marked (+Main).

In order to treat the behavior of spatial adjectives with respect to round and globular objects, it seems sufficient to use the markers (−Max) and (−Sec-

ond) for the dimensions involved. Nevertheless, since a feature (Round) appears to be necessary elsewhere – for instance in *Kurve, Bogen* and in *rund* itself – and since it may very well be a basic feature of perception, we will use it in the following examples:

(31)

(a) Topf

```
        ( 3 Space )
             |
         ( + Main )
         /        \
  (+Vert)        (-Vert)
     |              |
     |          (+Round)
     |              |
     |           (-Max)
     |              |
     |          (-Second)
     |            / | \
     1          2     3
```

(b) Rad

```
        ( 3 Space )
         /        \
  (+Main)        (-Main)
     |              |
  (+Round)          |
     |              |
  (-Max)            |
     |              |
  (-Second)         |
   /    \           |
  1      2          3
```

(c) Apfel

```
      ( 3 Space )
           |
       (-Vert)
           |
      (+Round)
           |
       (-Max)
           |
      (-Second)
        / | \
       1  2  3
```

(d) Kreis

```
      ( 2 Space )
           |
       (-Vert)
           |
      (+Round)
           |
       (-Max)
           |
      (-Second)
        /    \
       1      2
```
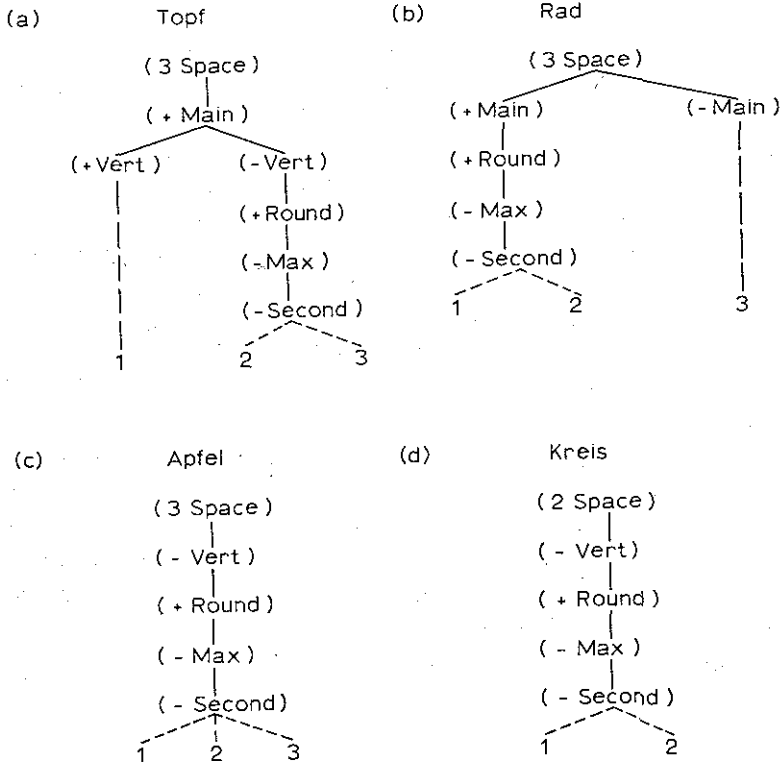
The marker (+Round) then represents globular shape, if all three dimensions are involved, and circular shape, if only two are involved. And we may add to (30) the clause:

(32)   At least 2 dimensions belong to the branch(es) dominated by (+ Round).

3.4. As mentioned above, the markers (±Inherent) may be inserted in these structures according to certain redundancy conventions. The same may hold for other markers as well. In general, it is clear, that to a certain extent structures of the kind exemplified in (29) and (31) are governed by general rules pertaining to the innate predispositions of concept formation and language

learning, which must not be stated in individual grammars. Those rules would then allow us to eliminate from the lexical entries all the markers specified by its application. So the markers $(-\text{Max})$ and $(-\text{Second})$ could surely be predicted from $(+\text{Round})$ for all dimensions subordinated to this marker and thus eliminated from (31)(a) through (d). Similarly $(-\text{Second})$ may be predicted from $(+\text{Max})$, but only within the same dimension, because another dimension may very well be marked $(+\text{Second})$. Perhaps rules of this kind may also guarantee, that only one dimension is marked $(+\text{Second})$, i.e., that $(+\text{Second})$ is dominated only once by (n Space), and so on. It seems clear to me, that the general principles of such a "marker syntax" as well as a certain set of specified rules with concrete marker content belong to the general theory that characterizes our basic semantic capacity. On the formal structure of those rules we will touch shortly in section 4.2.

On the basis of such structures as (29) and (31) it will become clear, how the scales, for which (Pol) indicates a certain value, are to be characterized. Such a scale is specified by certain markers which guarantee, that $(+\text{Pol})$ and $(-\text{Pol})$ are connected with all and only the appropriate dimensions. *lang*, for instance, will contain the markers $(+\text{Max})$ (which implies $(-\text{Second})$, as noted in the previous paragraph) and $(-\text{Vert})$. Thus it may be combined with *Wagen, Brett, Stange,* and *Zigarette,* but not with *Fenster* or *Turm* (which is $(+\text{Vert})$ in its only $(+\text{Main})$-dimension). *hoch,* on the other hand, is not marked for $(\pm\text{Max})$, but it is $(+\text{Vert})$, thus combining with *Wagen, Stange* (which is not $(-\text{Vert})$!), *Fenster* and *Turm,* but not with *Brett* or *Zigarette.* And it can also be seen, that *lang* and *hoch* must be related to different branches of the marker tree with respect to *Wagen,* but to the same branch with respect to *Stange.* Thus we can account for all facts of the kind exemplified above in (22).

But before we can state explicitly the semantic structure of the adjectives considered, some remarks on the presupposed formalism are necessary.

4. SOME REMARKS ON THE FORMAL ASPECTS OF A SEMANTIC THEORY

4.1. The following remarks on the formal structure of the theory presupposed in our analysis must, of course, be rather sketchy. The main purpose of the present article is to clarify the nature of semantic markers, exemplified by a set of German adjectives, and we will not go into the details of the assumed theory. Its more complete description and motivation must be given elsewhere. Let me note, however, that I will assume the basic principles of the theory developed by Katz, Fodor, and Postal as far as possible and that I will change it – somewhat radically – only in two points: the structure of the

lexical entries and the form of the semantic rules.[21] Let us turn then first to the lexical entries.

From our examples in (28), (29), and (31) it is clear, that we use marker trees instead of the marker strings (really: sets of markers) of Fodor and Katz. We will mention only one of the several reasons that motivate this assumption. It is impossible to predict the behavior of *lang* and *groß*, if certain objects were not to be marked simultaneously by both elements of a binary marker, say (+ Inherent) and (− Inherent) or (+ Vert) and (− Vert). But this, of course, would lead to an inherent contradiction, if simply sets of markers are presupposed.[22] Thus the contradictory (or antonymous) markers must be arranged in such a way, that they cannot conflict with each other. This is guaranteed by their arrangement on different branches of a tree, where, in our case, each branch represents the properties of different dimensions.[23] From this assumption it follows, that ordering of the markers is not arbitrary, as it would be in simple marker sets, but must conform to principles of subordination governing tree structure.

The next point to be noted is that the marker trees are not formally analogous to constituent structure trees, but rather to dependency trees. That means, two markers (M) and (N), branching from a Marker (P), are not dominated by (P), this being the category to which the string (M)(N) is assigned, but they are dependent on (P) in a sense similar to that formalized in the theory of dependency grammars. In technical terms, all markers of a marker tree are terminal elements.[24] This suggests that our proposed lexical entries may be based on the formal principles of dependency systems.[25] This allows us to represent the marker trees as strings of markers, bracketed

[21] It may be noted by the way, that Katz himself has abandoned the original principles of the structure of lexical entries and of the amalgamation rules, although without stating this change explicitly. Cf. notes 26 and 28 below.

[22] It might be objected, that one could avoid this dilemma by introducing different markers, say (Vert) and (Horizontal) instead of (+ Vert) and (− Vert). But this simply begs the question. (Horizontal) in this case would have not only the same interpretation as (− Vert), but it would also serve all its formal functions. (Vert) and (Horizontal) would be an antonymous pair of markers (in terms of Katz), and these cannot enter one set of markers without leading to a contradiction.

[23] This is the principle already used in syntactic trees. Two contradictory syntactic markers, say [+ Human] and [− Human] are allowed to occur in one Phrase-marker at the same time, but not within one complex symbol, without leading to a violation. For details see Chomsky, *Aspects of the Theory of Syntax*.

[24] Obviously, the same holds in a certain sense for the syntactic features within complex symbols as introduced by Chomsky, in so far as subordination between features is involved. Compare for instance the "feature trees" within the Phrase-marker on p. 108 of *Aspects of the Theory of Syntax*.
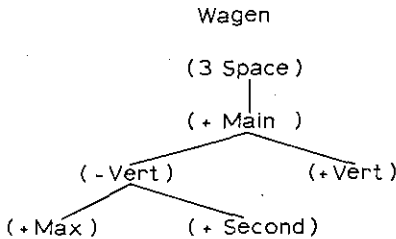
[25] We will use in the following the notational conventions of Gaifman, 'Dependency Systems and Phrase-Structure Systems', *Information and Control* **8** (1965) 304–37. There a dependency rule is formulated as follows: $X(Y_1, Y_2 \ldots Y_i * Y_{i+1} \ldots Y_n)$, which specifies

according to the principles developed in dependency theory. It must be stressed, however, that the provisional usage of some terminology and formalism of dependency theory made on the following pages is only for convenience and brevity, because we cannot develop a more adequate formalism in sufficient detail within the present paper. In general, dependency theory must not be taken as the formalization of the principles underlying the semantic structure of natural languages for several reasons, the most obvious of which is the fact that tree structure is not preserved as soon as relational markers are introduced in the theory. We cannot go into details here and would only note that the possibility of using dependency concepts in general and tree representation in particular is strongly dependent on the limitations of our present interests.
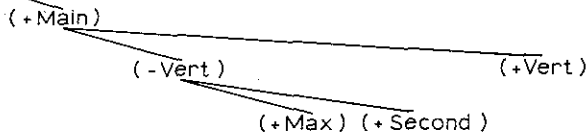
Before we illustrate this representation, it must be noted that within the

(33)

(a) Wagen

$$(3 \text{ Space })$$
$$(+ \text{ Main })$$
$$(- \text{Vert }) \qquad (+ \text{Vert })$$
$$(+ \text{Max }) \qquad (+ \text{ Second })$$

(b) (3 Space)
(+ Main)
(- Vert) (+ Vert)
(+ Max) (+ Second)

(c) [(3 Space)[(+ Main)[(-Vert)[[(+ Max)][(+ Second)]] [(+Vert)]]]]

semantic structure the linear order of the elements is completely irrelevant (which does not hold for the syntactic interpretation of dependency systems). The only relation that must be uniquely represented, is their relative de-

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a dependency (sub) tree of the form

$$X$$
$$Y_1 \quad Y_2 \quad \ldots \quad Y_i \qquad Y_{i+1} \quad \ldots \quad Y_n$$
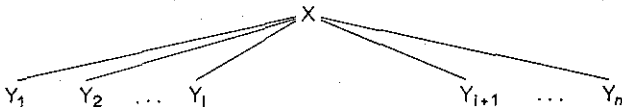
This in turn may be transferred to a parenthetical expression of the form $((Y_1)(Y_2)\ldots(Y_i)X(Y_{i+1})\ldots(Y_n))$. That means, a dependency rule specifies for a given element X a sequence of elements $Y_1, \ldots, Y_n$, that depend on X in that order, with X between Y_1 and Y_{i+1}.

pendence. This allows us to rearrange the marker trees topologically so, that the governing marker is always to the left of all its dependents. This form of the tree can be taken as the basis for a normalized bracketing of markers. Thus in the example *Wagen* (29)(a), we rearrange (33)(a) as (b), this then being the basis for the parenthetical expression (c). (Henceforth we use square brackets to indicate dependency.)

The semantic structure of a lexical entry can now be given as a string of markers, but with a superimposed dependency, represented as bracketing in the manner of (33)(c). This additional qualification is the critical difference between our concept and that of sense characterization proposed by Fodor and Katz.[26]

4.2. Although the semantic structure of lexical entries may be represented by dependency trees, which in turn can be specified by a dependency grammar, it would be pointless to construct a grammar that generates all and only the marker trees of a given lexicon. Rather the lexical entries must be given (and learned) item by item, but according to the general principles of the semantic structure. Nevertheless, there will be generative rules within the lexicon. As we have already noted, the combination of markers within the lexical entries is predictable to a certain extent, in part by universal redundancy conventions, in part perhaps, by language specific rules.

In order to sketch the form of these rules, we must generalize somewhat the notion of dependency rule. As defined by Gaifman, a dependency rule specifies a sequence of elements $Y_1, ..., Y_n$, that directly depend on a given element X. We will extend this definition in such a way, that a dependency

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[26] Recently Katz has also used additional bracketing in cases where mere concatenation of markers is too obviously inadequate. In *The Philosophy of Language*, p. 167, the following entry for *chase* is given (I have adjusted some brackets according to the comments on pp. 168–9, since the entry on p. 167 contains some misprints: 17 left parentheses are paired with 15 right ones):
chase → Verb, Verb Transitive, ...; ((Activity)(Nature: (Physical)) of X), ((Movement) (Rate: (Fast))(Character: (Following))), (Intention of X: (Trying to catch ((Y) ((Movement)(Rate: (Fast)))))); ⟨SR⟩.
The marker (Fast) is said to qualify the marker (Movement) as to nature, (Following) qualifies it as to character. X is a dummy symbol to be replaced by the markers of the subject, Y is to be replaced by the markers of the object. The formal status of the different brackets, of ":" and of "of" is not discussed. Whether a formalization in terms of dependency relations, which would be possible, is in accordance with the intentions of Katz, is not clear to me. However, some formalization would be necessary, and it will clearly involve much more structure than pure marker concatenation. Note, by the way, that the use of the dummies X and Y results in a type of projection rule, which clearly exceeds the formation of set unions underlying the originally proposed amalgamation rules. In fact it amounts to something like the operation proposed below as "generalized dependency rule". Cf. also note 24.

rule places a given element X at a specified place in a given dependency tree. This may be done in the following manner:

(34) If Y is an element of a given dependency tree, then by the rule

(a) X[Y[*]] the element X is introduced in the tree as a direct (right) dependent of Y;

(b) X[*[Y]] the element X is introduced in the tree as the direct (left) governer of Y and X depends on that element, on which Y was dependent before the rule application.

Instead of the single elements X and Y in the rules we may specify entire branches and subtrees of the trees that are to be operated on or inserted.[27] Of course, all these notions must be formalized more carefully. But here we cannot go into this any further. We only give some examples of the above mentioned redundancies within the semantic structure of space:

(35) (a) (−Inherent) [*(+Vert)]

(b) (−Inherent) [*(+Observ)]

(c) (−Second) [(+Max) [*]]

(d) [(−Max) [(−Second)]] [(+Round) [*]]

The rules (35)(a) and (b) insert (−Inherent) between (+Vert) and (+Observ) respectively and their governing markers. (35)(c) subordinates (−Second) to any occurrence of (+Max) in the lexicon. And (35)(d) makes the whole

(36) (a)   Topf   (b)   Topf
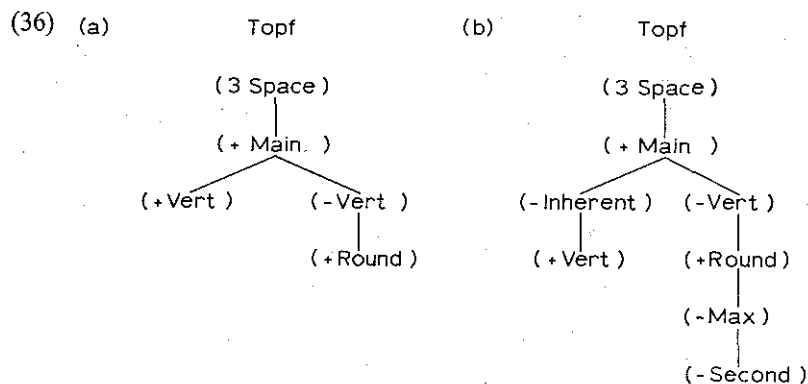
subtree [(−Max) [(−Second)]] dependent on (+Round). If we supply the lexicon with the rules (35), then for instance *Topf* may be represented as (36)(a) instead of the former representation (31)(a). And (36)(a) will be turned into (36)(b) by application of (35)(a) and (d).

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[27] Obviously the original dependency rule as given in note 21 may be treated as a special case of (34)(b), where all the $Y_1 \ldots Y_n$ are governing elements of unconnected subtrees, dependent on no other element before the rule application and therefore dependent on X when the rule has been applied.

The same treatment of redundancies could be exemplified with the other entries in (29) and (31). As far as the rules (35) are universal – and I would guess they are not idiosyncratic for German – they represent to a certain extent the organization of space structures by human beings.

4.3. Now it is most important to note, that the redundancy rules are by no means the only rules of the lexicon. Rather the semantic structure of all lexical entries must be constructed in the form of rules combining structured marker sets. Although this principle concerns lexical items in general – including nouns, verbs and prepositions – we will restrict our attention here to the adjectives so far considered.

From the discussion in sections 2 and 3 it will be clear, that the meaning of the adjectives in question is to be understood as an instruction to place the (Pol)-marker into the marker tree of the modified noun in such a way, that all and only the appropriate dimensions are additionally marked by $(+Pol)$ or $(-Pol)$. This leads to the following conception: The remainder R of section 2, that marks the scale to be modified by (Pol), is to be constructed formally as a dependency subtree with a marked place for the insertion of (Pol). This subtree together with the (Pol)-marker then forms a dependency rule of the kind roughly characterized by (34). But here a further clarification is in point. We may call the left hand side of a generalized dependency rule, the part to be inserted somewhere, its modification, and the right hand side of the rule its domain. That is, the (Pol)-marker constitutes the modification of the adjectives under consideration, the remainder R constitutes their domain. Now we define the notion of "matching domain" as follows:

(37) Let D be the domain of a generalized dependency rule with X as one of its elements, and T a dependency (sub)tree containing X, then D and T match if and only if for each two elements Z_i and Z_j of D the following holds: if Z_i depends (directly or indirectly) on Z_j in D, then Z_i depends (directly or indirectly) on Z_j in T, in case Z_i and Z_j are in T.

The last clause in (37) guarantees, that D and T match also if not all the elements of D are in T. That at least one element is common in D and T follows from the condition, that the topmost element of D is also in T. And as far as the elements of D are in T, the same dependency hierarchy holds in D and T, if the domain and the tree match. The only element that is always in D, but usually not in T, is the place keeper $*$. We may now define the application of a generalized dependency rule as a two step operation in the following way:

(38) A generalized dependency rule P with a domain D that matches a dependency tree T, is applied to T in the following two steps:

(a) first each element Z_i dependent on Z_j in D, which is not in T, is inserted in T in such a way that Z_i depends on Z_j also in T;

(b) secondly the governing element X of the modification M of P is substituted in T for the * introduced by step (a). All elements dependent on X in M are also dependent on X in T.

It can easily be seen that the place of * in the dependency tree T is uniquely determined by operation (38)(a). In fact, the insertion of * may often be the only effect of step (a). This, for example, holds trivially for the application of the redundancy rules (35). All these notions must be made more precise. But again we can only illustrate them here by an example. Let (39) be the entry for *hoch* and (40) one branch of the entry for *Stange* with all redundancies filled in.

(39)   hoch: (+Pol) [(+Main)[*[(−Inherent)[(+Vert)]]]]

(40)   Stange: [(Phys Obj)][(3 Space)[(+Main)[(+Max)[(−Second)]]]]]

Obviously, the domain D of (39) and the tree T, of which (40) is a branch, match, because they have the element (+Main) in common and there are no elements in D with nonmatching dependencies in T. In fact, (40) is the only branch in the entry of *Stange* that has an element in common with (39). It follows, therefore, that the rule (39) can be applied to (40), in case *hoch* and *Stange* appear in a sentence like *Die Stange ist hoch*. This will be done in the two steps (41)(a) and (b):

(41)   (a) [(Phys Obj)][(3 Space)[(+Main)[*[(−Inherent)[(+Vert)[(+Max) [(−Second)]]]]]]]]

   (b) [(Phys Obj)][(3 Space)[(+Main)[(+Pol)[(−Inherent)[(+Vert) [(+Max)[(−Second)]]]]]]]]

After this rule application the markers of *hoch* are completely absorbed by the marker tree of the modified noun and *Stange* is now marked as (+Pol) and (+Vert), which implies (−Inherent), for its maximal dimension. That is exactly the desired result: The marker (+Vert) represents the fact, that *Stange* is understood as referring to a vertical object. For comparison consider the following tentative entry for *lang*:

(42)   lang: (+Pol)[(+Main)[*[(+Inherent)[(+Max)[(−Second)]]]]]

The domain of (42) also matches with (40) as the only branch in the entry for *Stange*. But the application of (42) to (40) inserts only * and (+Inherent) in the first step and the result of applying (42) in a sentence like *Die Stange ist lang* results in (+Pol) marking for the now inherent maximal dimension:

(43)   [(Phys Obj)][(3 Space)[(+Main)[(+Pol)[(+Inherent)[(+Max)[(−Second)]]]]]]]

This reflects the fact, that in *Die Stange ist lang* nothing is said about verticality and that *Stange* designates an object which is understood as having an inherent maximal dimension.

From these examples it can be seen, that the domain D of a lexical entry such as (39) or (42) functions somewhat like the selection restriction of the Fodor-Katz-theory. The amalgamation of the noun and its modifier – that means now: the application of the generalized dependency rule, given as the sense characterization of the adjective – is possible only if the noun fulfils the conditions stated in D.[28] This function of D as selection restriction is given by the definition (37) for matching. But the domain D serves one further purpose. By the convention (38)(a) for rule application the domain D also introduces new markers in a given tree. This corresponds in a certain way to the transfer features recently proposed by Weinreich.[29]

5. LEXICAL ENTRIES FOR SPATIAL ADJECTIVES OF GERMAN

5.1. After these rather sketchy remarks on the general background we can return to particular problems of the semantic structure of the adjectives in question.

First of all, the values of the (Space)-markers require further clarification. Consider the following examples:

(44) (a) Das Brett ist lang.
     (b) Das Brett ist breit.
     (c) Das Brett ist dick.
     (d) Das Brett ist groß.

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[28] Compare in this connection the analysis of *good* given by Katz in *The Philosophy of Language*, p. 296:

$$\text{good} \rightarrow \text{Adjective, ...; } (+) \langle (\text{Eval}_x\text{: ( )}) \rangle$$

The selection restriction $(\text{Eval}_x\text{: ( )})$ states, that the noun to be modified by *good* must have the marker(s) specifying evaluation with respect to a certain aspect x, say function, purpose, duty etc. The empty brackets indicate the place, where the marker $(+)$ has to be inserted finally. It can easily be seen, that the semantic part of that entry can be given as a generalized dependency rule as follows:

$$\text{good: } (+ \text{ Pol})[(\text{Eval})[*]]$$

[29] Weinreich, 'Explorations in Semantic Theory', in *Current Trends in Linguistics* 3, The Hague 1966. There instead of the selection restrictions of Fodor and Katz a special kind of markers is proposed, which are, according to a general rule, transferred from a given word to the modified constituent, where they then act as normal semantic elements. If the insertion of transfer features conflicts with the ones already present, then a violation results. But that is just the case when – in terms of our conception – D and T do not match. And we may therefore define the notion "violation with respect to marker X" as the result of an application of a rule P to a tree T, although T does not fulfil the matching condition with respect to marker X. Thus, for instance, the sentence *Die Zigarette ist hoch* would contain a violation with respect to (Vert).

(e) Die Stange ist lang.
(f) Die Stange ist hoch.
(g) Die Stange ist dick.
(h) Die Stange ist groß.
(i) Der Wagen ist groß.

In (a), (b), (c), (e), and (f) clearly one dimension is involved. (The difference between (e) and (f) was discussed above.) But *groß* concerns two dimensions in (d), only one in (h), and three in (i). *dick* specifies only one dimension in (c), but two dimensions in (g). That is, the dimensionality of *groß* and *dick* is variable, that of *lang, breit,* and *hoch* is always exactly one. We may represent this observation by using (1 Space) for the latter words and (n Space) for *dick* and *groß* with n as the number of all ($+$ Main) marked dimensions of the modified noun in case of *groß* and all the ($-$ Main)-dimensions in case of *dick*. It must be noted, that an important feature of the interpretation of the (Space)- and (Pol)-markers corresponds to this n-dimensionality: The ($+$ Pol) or ($-$ Pol)-marker, determined by (n Space), must not be understood as marking each of the n dimensions separately, but as a specification of the product of the n major or minor dimensions involved. In a sentence like *Peters Wagen ist größer als Gustavs Wagen* it is not asserted that Peters car is longer, broader, and higher, but only that it is bigger with respect to the general impression, and that is, with respect to the product of all three dimensions. Other examples would show the same for two dimensions. For $n = 1$ this observation holds trivially: The product of one dimension is that dimension itself. So the sentences *Die Nadel ist zu groß* and *Die Nadel ist zu lang* express the same assertion.

With this interpretation of the values for (Space) in mind, we need an additional convention about the compatibility or matching of (Space)-markers with different values. We may postulate that a marker (i Space) satisfies the conditions for matching with respect to a marker (j Space), in case $i \leq j$, or more formally:

(45) Let (i Space) and (j Space) be two markers with $i \leq j$. Then (i Space) is said to be an instance of (j Space).

With this definition (n Space) is an instance of (1 Space), (2 Space), and (3 Space), since the variable value of n may be always taken to be equal to or less than 1, 2, or 3. The convention (45) looks somewhat ad hoc, and this may indicate that something is not correctly understood with respect to the representation of space and dimensionality. But it may very well be that something like (45) holds for other markers as well, so that this convention can be formulated more generally. Nevertheless, for the moment we

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must be content with the rather narrow formulation (45). Technically, (45) guarantees that a domain containing (*n* Space) or (1 Space) can match with each tree containing (2 Space) or (3 Space).

5.2. The second problem to be discussed is the fact, that not all the (+Pol) *space adjectives have simple and unique antonymous counterparts.* In (7) we have already listed *nah* and *eng* as different antonyms to *weit* and *dünn* and *schlank* as antonyms to *dick.* This implies that *weit* and *dick* must be characterized by at least two different meanings, one for each of its counterparts. Of course, further meanings must be accounted for, which will not concern us here, for instance the meaning of *weit* in *ein weiterer Komplex,* in the sense "a further complex" as opposed to the sense "a less narrow complex". But even if we restrict our attention to the antonyms of *nah* and *eng,* the facts are still more complicated. Consider the following sentences:

(46)   (a) Das Ziel ist weit.   Das Ziel ist nah.
      (b) Der Weg ist weit.   Der Weg ist nah.
      (c) Der Weg ist weit.   Der Weg ist kurz.
      (d) Der Weg ist lang.   Der Weg ist kurz.

The examples (46)(a) and (b) show, that *Der Weg ist weit* is ambiguous, meaning either the road as a whole is far from here – with *weit* antonymous to *nah* – or the road is long, and then *nah* cannot serve as counterpart. In (46)(c) *weit* is understood as parallel to *lang.* In all these cases *weit,* and of course *nah,* specify only one dimension, whereas *weit* with the antonym *eng* involves at least two dimensions and must be marked (*n* Space). Only the pair *weit/nah* can enter into Adverbials of the form *weit vor der Stadt, nah am Abgrund,* as exemplified in (26). And only in that sense *weit* must be marked (−Inherent). The antonymous pair *weit/eng* on the other hand, if these are strictly antonymous at all, seems to require a further marker representing the fact, that a distance between certain objects or parts of an object is intended. This apparently follows from such cases as *eine enge Straße, der weite Platz, eine weite Öffnung* etc. From *groß/klein* here *weit/eng* are distinguished by the clear indication of the distance between certain borderlines and the foregrounding of the space between them. We will represent this by a tentative marker (+Distance), that must be taken as a mere label for a gap to be filled in by further investigations.

Similar complications arise with respect to *tief/flach.* The following examples show that *flach* is not simply the antonym to *tief:*

(47)   (a) Der Fluß ist tief.   Der Fluß ist flach.
      (b) Das Haus ist tief.   Das Haus ist flach.
      (c) Er war tief im Wald.   *Er war flach im Wald.

Only in (47)(a) *flach* functions as antonym to *tief*. (47)(b) demonstrates that *flach* qualifies an object in a certain sense as plain with respect to the horizon of a given observer. *tief* on the other hand is not sufficiently characterized as the (+Pol)-element for the observer oriented dimension. It simultaneously indicates that this dimension constitutes something like an interior, if referring to an object with more than one dimension. We represent these facts by the markers (+Plain) for *flach* and (−Plain) for *tief*, that are as provisional as (+Distance). And although it seems plausible that *tief* and *flach* behave in a certain sense as antonyms not because of the (Pol)-marker, but because of this (Plain)-marker, it may very well turn out that quite another analysis is necessary, where (+Plain) and (−Plain) are not primitive elements. (We completely ignore the meaning of *tief* as the antonym to *hoch* with respect to pitch.)

The difficulties are somewhat different with *dick/dünn*. It seems to me, that these are true antonyms, but they too require additional marking. The property relevant for this pair concerns density and may be paraphrased as "resistence to penetration". It must be left open, whether this property constitutes a true primitive element of the universal marker alphabet. We represent it tentatively by (+Density).

5.3. We are now ready to state the sense characterization of the adjectives explicitly. We presuppose, that at least the redundancy rules (35) are included in the lexicon. Therefore the sense characterizations will be given redundancy free. We omit also the necessary syntactic features are to must qualify the elements as adjectives, and determine whether they may function as adverbs or not.

(48) (a) lang: (+Pol) [(1 Space)[*[(+Inherent)[(+Max)]]]]
      (b) kurz: (−Pol) [(1 Space)[*[(+Inherent)[(+Max)]]]]
(49) (a) breit: (+Pol) [(1 Space)[*[(+Second)]]]
      (b) schmal: (−Pol) [(1 Space)[*[(+Second)]]]
(50) (a) hoch: (+Pol) [(1 Space)[*[(+Vert)]]]
      (b) niedrig: (−Pol) [(1 Space)[*[(+Vert)]]]
(51) (a) weit: (+Pol) [(1 Space)[*[(−Inherent)]]]
      (b) nahe: (−Pol) [(1 Space)[*[(−Inherent)]]]
(52) (a) groß: (+Pol) [(n Space)[(+Main)[*]]]
      (b) klein: (−Pol) [(n Space)[(+Main)[*]]]

These are the primary spatial meanings, that can be accounted for in terms of the markers established in sections 2 and 3. Since (Space) is intended to be a very abstract feature, (48) through (52) represent to a certain extent also the meaning of the adjectives as modifiers of abstract nouns. (48) for

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instance accounts for *lange Zeit, ein kurzer Tag,* (52) may account for cases such as *große Bedeutung, große Angst* and even *große Länge, große Höhe,* etc.[30] Some minor adjustments may be necessary; in particular it must be explained that the normal antonymous adjective for the abstract use of *groß* is not *klein,* but *gering:* the correct combination is *geringe Höhe, geringe Hoffnung,* etc., instead of **kleine Höhe, *kleine Hoffnung.*

With some reservation we will now formalize the meaning of *weit* vs. *eng, dick/dünn* and *tief/flach.*

(53) (a) weit: $[(+\text{Pol})[(+\text{Distance})]]$ $[(n \text{ Space})[(+\text{Main})[*]]]$
      (b) eng: $[(-\text{Pol})[(+\text{Distance})]]$ $[(n \text{ Space})[(+\text{Main})[*]]]$

Here the modification of the generalized dependency rule consists not of a single marker, but of the branch $[(+\text{Pol})[(+\text{Distance})]]$ and $[(-\text{Pol})[(+\text{Distance})]]$ respectively. This means that we assume $(+\text{Distance})$ not as a marker of the domain that may or may not already be a feature of the modified noun, but as an element always inserted by the adjective and not present before. If this turns out to be incorrect, then (53) must be changed.

As already shown, *tief* and *flach* are not strictly parallel, and for the moment the following characterization may best account for the facts:

(54) (a) tief: $[(+\text{Pol})[(-\text{Plain})]]$ $[(1 \text{ Space})[*[(+\text{Observ})]]]$
      (b) flach: $(+\text{Plain})$ $[(1 \text{ Space})[*[(+\text{Inherent})]]]$

tief and *flach* are then antonyms with respect to (Plain), not to (Pol), and *flach* cannot be used in Adverbials such as **flach im Wald,* because of the marker $(+\text{Inherent})$ in its domain. $(+\text{Inherent})$ in turn excludes $(+\text{Observ})$.

An adequate characterization of *dick* and *dünn* is most difficult. Although *dick* seems to have two completely different meanings in the two sentences *Die Tür ist dick* and *Die Suppe ist dick,* these meanings are obviously related somehow. But for the time being I know of no plausible way to represent this relationship. We will, therefore, state the purely dimensional meaning of *dick/dünn* under (55) and rather provisionally a separate meaning with respect to consistency under (56):

(55) (a) dick: $(+\text{Pol})$ $[(n \text{ Space})[(-\text{Main})[*]]]$
      (b) dünn: $(-\text{Pol})$ $[(n \text{ Space})[(-\text{Main})[*]]]$
(56) (a) dick: $(+\text{Pol})$ $[(+\text{Consistence})[(+\text{Density})[*]]]$
      (b) dünn: $(-\text{Pol})$ $[(+\text{Consistence})[(+\text{Density})[*]]]$

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[30] We cannot go here into the details of the nominalization of the adjectives. But it can readily be seen, that they will form abstract nouns with the marker (Space) as the governing element of its sense characterization. This then will guarantee the matching of these trees with the domain of *groß.*

A more detailed investigation of the not purely spatial properties of semantic structure must clarify the relationship between primary spatial meanings of the adjectives considered so far, and their other, somehow "derived" meanings. Such a study may reveal deeper insight even in the spatial structure itself. But that goes beyond the scope of the present paper.

6. CONCLUSIONS

6.1. It goes without saying, that the description of a set of German adjectives we have sketched is rather incomplete and much in need of revision. Further investigation may change the details in several respects. But I hope that certain principles have become clear. Although I do not believe that all the markers introduced more or less tentatively may enter the universal set of semantic markers, I would like to claim that there are serious candidates for the universal set among them. And certain conclusions as to their nature and their combination can be drawn.

First of all, the primitive elements that enter semantic descriptions have not necessarily a simple interpretation in terms of physics, geometry, biology and so on. It may presumably be the normal case, that a linguistically simple and elementary feature is rather complex with respect to its physical or physiological interpretation. This may become clearer by a comparison with phonological features. Accent for instance is with all its degrees a linguistically homogeneous structure, whose interpretation in articulatory and acoustic properties is rather complex: certain distinctions quite clearly made within the phonological structure are not present in the signal at all. Others are realized by duration, pitch and intensity simultaneously.[31] Similar complications may hold with respect to the interpretation of the semantic features.

Second, the primitive semantic elements are not isolated features that must be learned item by item in the process of language acquisition and interpreted in the linguistic theory strictly separated from each other. They are rather features of whole structures, such as normativity, spatiality, verticality, etc. There may be further dependencies between those structures. For instance, the specification of a maximal and a secondary axis may be possible only with respect to main dimensions. Those relations may in fact depend on the apperceptive structure, that is represented in the semantic markers. Linguistically they are expressed in part by semantic redundancy rules. This may result in a partial ordering of the universal elements, the markers thus being a structured, instead of an unordered set.

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[31] For a more detailed treatment of the interdependency between accent, intonation, pitch, and loudness see for instance Bierwisch, 'Regeln für die Intonation deutscher Sätze', *Studia Grammatica* 7, Berlin 1966.

Third, all these markers (and the complex structures that they represent) must be thought of as part of the innate capacity for language learning. Therefore, what a child must be taught is not what a norm is, how space is structured, etc., all this being innate and developing spontaneously, but only how and in which combination these structures are expressed. This seems to me the only possible basis on which one can explain that a child may have grasped the whole complex semantic structure of his language before learning even the smallest bit of physics, geometry, and so on.

And fourth, the formation of the primitive elements to the meanings of particular languages is governed by general principles of combination. These principles are by no means trivial, as our analysis has clearly shown. They too must be an innate part of the capacity of language learning, emerging, but not learned in the course of language acquisition. It must be left open what the correct formalization of these principles finally turns out to be. But we have shown that unstructured sets of markers cannot represent the complexity of the meanings of natural languages.

6.2. After this discussion of the theoretical status of the semantic markers and the principles of their combination we may turn back to the question (2) raised at the outset: Just what are the universal elements and how can they be established? It is clear that the relation of language and thought, the necessary set of semantic primitives and its interpretation from our point of view is not a matter of a priori speculation. It may be approached only by tentative analysis of different languages, by checking the results against each other and against psychological, physiological and biological insights. In this way linguists may raise interesting questions to be answered by psychologists, and psychologists may check their results by comparison with linguistic requirements.

This may be phrased as an heuristic principle in the following way: A semantic analysis of a lexical item is finished only if it leads to a combination of basic elements, that are true candidates for the universal set of semantic markers, i.e., that may be interpreted in terms of basic dimensions of the human apperceptive apparatus. Such a principle would impose on semantic analysis the requirement of revealing interpretability in addition to that of preciseness and internal consistency. It would prevent any vague speculation rather strictly.

These considerations may also shed some light on such complicated and central problems as figurative meaning, metaphor, synaesthesia, etc. We have already mentioned the transference of spatial designations to temporal and other abstract relations. The question immediately carries over to all other kinds of "derived meaning". What is the basis for such sentences as *Der*

Preis ist hoch or *Er steckt tief in Schulden*? I am sure that we may come to a far better understanding of these mechanisms, if we look at them against the background of the apperceptive structures of the organism and its manifestation in the basic elements of the semantic structure and their principles of combination.

Ultimately all these remarks and suggestions serve the purpose to become better acquainted with "the notion, that man may be equipped with highly specialized, biological propensities that favor and, indeed, shape the development of speech in the child and that roots of language may be as deeply grounded in our natural constitution as, for instance, our predisposition to use our hands".[32]

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[32] Eric H. Lenneberg, 'The Capacity for Language Acquisition', in *The Structure of Language* (ed. Fodor and Katz), Prentice Hall, Englewood Cliffs, N.J., 1964, p. 579.