Approaching the Semantics of Distance Expressions: Problems and Perspectives

Kai-Uwe Carstensen

Universität Osnabrück
Fachbereich Sprach- und Literaturwissenschaften
Arbeitsbereich Computerlinguistik und Künstliche Intelligenz
Postfach 4469, Sedanstraße 4, 4500 Osnabrück
Tel.: 0541/969 2584; Fax: 0541/969 2500; e-mail: carstens@dosuni1.bitnet

Abstract

The treatment of spatial expressions (prepositions, verbs, dimensional adjectives) has become a prominent subtopic of lexical semantics during the last decade. In spite of this fact, distance expressions – also belonging to this lexical field – have been ignored for the most part. In this paper, I want to argue that this neglect is not due to the triviality of the matter, but rather to its inherent difficulties. This is shown via an analysis of some of the problems involved, followed by a proposal which is both a partial solution and a framework guiding future research.

1. Introduction

As regards the formal specification of the semantics of spatial expressions, some advances have been achieved within the past ten years or so. Not only has a detailed proposal for the semantics of dimensional adjectives been made (cf. Lang 1987, Bierwisch/Lang 1987a) but there exist also – in part going back to Wunderlich 1981/82 – numerous papers aiming at a coherent description of the semantics of spatial prepositions (cf. Bierwisch 1988, Habel 1989, Habel/Pribbenow 1988, Herweg 1989, Wunderlich/Herweg 1990) and verbs (Maienborn 1990, Wunderlich/Kaufmann 1990) within the framework of Bierwisch´s "two-level semantics" (cf. Bierwisch 1983).[1] Distance adjectives like <u>weit</u> (<u>far</u>), <u>hoch</u> (<u>high</u>), and <u>tief</u> (<u>deep</u>), however, which seem to be semantically very similar to dimensional adjectives[2] and furthermore bear a close relationship to other spatial expressions (at least) syntactically, somewhat surprisingly have been only scarcely discussed. In the following, I will first motivate a detailed analysis of the semantics of distance adjectives by showing the non-triviality of this topic. I will then point out characteristic problems for current approaches. Finally, a framework for doing away with some of these problems is proposed as a perspective for further work to be done.

2. Motivation

According to a recent proposal of Wunderlich/Kaufmann (1990), the semantic entry of a generic distance adjective is the one given in (1). Leaving out the notational details (for these, see Bierwisch/Lang 1987a), the complex lambda-expression here can be regarded as an

---

[1]   As this would definitely go beyond the scope of this paper, I do not discuss the (even more extensive) work done in the field of 'cognitive semantics' although I would claim the same label for my approach.

[2]   Observe that the German adjectives may have both a dimensional and a distance interpretation.

open two-place predicate, with the lambda operators representing the arguments and the body of the expression representing the decompositional semantic form of the adjective, respectively.[3] Roughly, the semantic form is to be interpreted as follows: 'the quantum of the distance from y to x equals the sum of a difference value c and a comparison value v on a certain scale'.

(1)   distance adjective: $\lambda c\ \lambda x\ [QUANT\ (DIST'\ (y, x)) = [v \pm c]]$[4]

(1') $[_{AP}$*100m hoch* $]$*(über)* $\lambda x\ [QUANT\ (VERT'\ (y, x)) = [0 + 100m]]$
      $[_{AP}$100m high$]$ (above)

(2)   dimensional adjective: $\lambda c\ \lambda x\ [QUANT\ (DIM\ (x)) = [v \pm c]]$

(2') $[_{AP}$*100m hoher*$]$ *(Turm)* $\lambda x\ [QUANT\ (VERT\ (x)) = [0 + 100m]]$
      $[_{AP}$100m high$]$ (tower)

(1'), for example, shows the semantics of a distance AP, where the internal argument is bound to a specific measure phrase. Note that the lambda expression represents a **property of an object**, namely, 'to be in a vertical distance of 100m from some y'. It should be of no surprise that this treatment of distance adjectives is very similar, and in fact analogously constructed, to that of dimensional adjectives (2, 2'). Apparently, the difference between distance and dimensional adjectives is captured intuitively and straightforwardly by the difference in whether an object external ("between two objects") or object internal distance is measured.

In addition to this nice result, the current treatment seems to be supported by the fact that distance adjectives can easily be combined with local expressions. According to Bierwisch (1988) and Wunderlich/Herweg (1990), spatial prepositions express a relation that can be described as 'x is located in a preposition-specific region with respect to y' (see 3). Local phrases, too, therefore denote **properties of objects** (3'). Thus, an expression like *100 m hoch über dem Hügel* can be represented by the fusion of the respective properties again yielding a property of some object, which is the desired analysis (see (4); the view of modification that is tacitly assumed here goes back to Higginbotham 1985) .

(3)   spatial preposition: $\lambda y\ \lambda x\ [LOC(x, PREP^*(y))]$

(3') $[_{PP}$*über dem Hügel*$]$ $\lambda x\ [LOC(x, ÜBER^*(Hügel))]$
      $[_{PP}$ above the hill$]$

(4) $[_{PP}$*100 m hoch über dem Hügel*$]$ λx $[LOC(x, ÜBER^*(Hügel)$
                                 $\&\ QUANT\ (VERT\ '(y, x)) = [0 + 100m]]$

Although the whole story about distance expressions seems to have been told, the plot is much more complicated than to allow a happy end already. In fact I suppose that after having been reconstructed, the story will rather turn out to be a Poean masterpiece than look like an instance of trivial literature. There are at least three points which support this view.

First, the compositional semantic treatment of local and distance expressions as separate properties of objects simply does not reflect the subtle linguistic differences in the combinatorics of the respective expressions, that is, the syncategorematicity of distance adjectives. As I will have to say much more about this in section 3, I will give but one example here to show that a **non-extensional** treatment of these combinatorics is required: In

---

[3]   In the terminological convention to be adopted here, the innermost lambda operator will be referred to as the external argument, the others as the internal arguments of the predicate.

[4]   [v + c] characterizes the unmarked adjective *weit*, [v - c] characterizes *nahe*.

(5), the local and distance aspects of a certain situation are described by two acceptable sentences; although identical **in extensio**, however, (5') is not acceptable.

(5)   *Der Baum ist beim Haus.   Genauer, der Baum ist 10m weit vom Haus entfernt*
        The tree is near the house. To be more exact, the tree is   10m   far   from the house
distant
(5')   **Der Baum ist 10m weit beim Haus*
        *The tree   is 10m far   near the house

Second, the **argument structure** of distance adjectives has received divergent treatment. According to the proponents of (1), the starting point of the distance to be measured is a free variable to be bound on the conceptual level (as is required with respect to y in (1)). In contrast to this, Lang (1987) views the starting point as an optional argument of the adjective (see (6)) in order to provide for the possibility of incorporating a source expression like in *weit von hier* (*far from here*) (see (7)). So we are left with the basic question of when/whether a local PP functions as a head to be modified by a distance adjective (in the case of *über*) and when/whether it functions as an argument (in the case of *von*) of such an adjective.

(6)   distance adjective: $\lambda c \, (\lambda y) \, \lambda x \, [QUANT \, (DIST' \, (y, x)) = [v \pm c]]$
(7) $[_{PP}$*100m weit von hier*$]$: $\lambda x \, [QUANT \, (DIST' \, (VON\_HIER, x)) = [0 + 100m]]$

(8) $[_{NP}$*weiter Weg*$]$, $[_{NP}$*weite Reise*$]$,   *$[_{NP}$*naher Weg*$]$, *$[_{NP}$ *nahe Reise*$]$
        $[_{NP}$ far   way$]$, $[_{NP}$ far   travel$]$, *$[_{NP}$ near way$]$, *$[_{NP}$ near travel$]$

Third, even the basic semantic treatment of distance expressions as properties of objects ('to be in a certain distance to another object') seems to be problematic if not wrong. In (8), the adjectives modify the nouns **directly**, that is, with the interpretation 'a way which has a great/ *small distance' instead of 'a way which is in a great /*small distance from y'. Apart from the question of how to exclude the starred expressions, these examples obviously cross the heretofore clear distinction between object internal (dimensional) and object external (distance) extent measurements.

3.   Problems of the semantics of distance expressions

        In this section, I will discuss the problems of the current approaches to the semantics of distance adjectives in some more detail. Although I shall argue on different levels, the crucial assumption will be that a correct analysis of the pertinent phenomena hinges on how the semantic entries of the lexical items are designed.

### 3.1 The combinatorics of local and distance expressions

        One of the central observations regarding distance expressions is that they combine differently with local expressions. In German, three broad classes of interactions can be distinguished according to whether a modification with *nahe* (9a) or *weit* (9b), or both (9c), leads to inacceptability of the whole phrase. Only instances of the first and second class will be discussed in this paper.

(9)   (a) *weit/*nahe hinter*   (b) **weit/nahe an/bei*   (c) **weit/*nahe in/zwischen*
            far/*near behind   *far/near by   *far/*near in/between

(10) *100 m über dem Meer*
    100 m above the sea

The semantic properties of distance adjectives are characterized by Wunderlich/Kaufmann (1990) as follows: (i) they are trinary predicates with only two overt arguments (θ-roles), i.e., an internal role for the grade of distance and an external role for one of the two distance points, (ii) the second distance point is a free parameter to be instantiated on the conceptual level by the context, and (iii) for this instantiation the current situation has to provide for a suitable spatial dimension. Note that the grade of distance, which is usually referred to by a measure phrase (*100 m*), is treated as an argument of the adjective. This seems to be in conflict with cases like (10) where an adjective is missing. However, Wunderlich/Kaufmann argue convincingly for an exceptional treatment of such cases. This is in line with the conclusion drawn by Bierwisch (1988) from his discussion of 'problems with measure phrases': "Bare MPs [Measure Phrases] would then have to be analyzed as governed by an empty adjective the SF of which is essentially that of *weit*, which is the most unspecified case of a distance adjective." (Bierwisch 1988:49).

  That point being settled, I will now turn to specific problems of the combinatorics of local and distance expressions. At first, let me introduce a scenario that can be used as a sufficiently restricted referential basis for expressions to be discussed. Figure 1 schematically depicts such a situation: an object I is located vertically between the objects M and W, and in a distance of 100 m to M, W and some other object O.[5] Formally, some of the relevant relations can be represented as in (11). It is rather obvious, then, that expressions like *100 m hoch/weit über M* (100 m high/far above M) and *100 m tief/weit unter M* (100 m deep/far below W) can be given the semantic representations like the one in (4).

figure 1
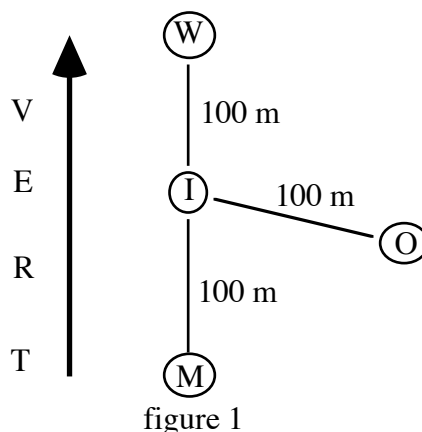
(11) LOC(I, ÜBER*(M)) & LOC(I, UNTER*(W)) &
    QUANT(VERT(DIST'(M, I))) = [0+100] &
    QUANT(OBS(DIST'(W, I))) = [0+100]

(12)   100 m weit über M
(12') (a) [$_{PP}$ 100 m weit über M]
   (b) [$_{PP}$ [$_{PP}$ 100 m weit] [$_{PP}$ über M]]
(12") λx [LOC(x, ÜBER*(M)) & QUANT(DIST'(z, x)) = [0+100]]

---

[5] M, I, W can be regarded as representing the sea (*Meer*), the mythical **Ikarus**, and the clouds (*Wolken*), respectively.

But how are these representations established in interpretation? How much linguistic structure is needed or used to determine acceptable content? First consider (12). This expression has two different non-directional (!) interpretations, namely, 'to be located in the above-region of the sea in a distance of 100 m from it' (12'a) and 'to be located in the above-region of the sea in a distance of 100 m from some object z' (12'b). Although intuitions seem to diverge on this point, let us assume that (12'a) is the standard interpretation of (12) or, in other words, that there is a **preference** for (12'a). (12") as semantic representation of (12), however, gives no clue with respect to whether it is derived from (12'a) or from (12'b)! Therefore, the two interpretations cannot be distinguished for the hypothesized preferential ordering.[6] It might perhaps be objected that this is not a semantic problem at all, instead belonging into the realm of performance. In this respect it is interesting to note, however, that recent psycholinguistic parsing models themselves are based on semantic notions (cf. the principles of 'lexical strength', 'head-' and 'theta-attachment' in Hemforth et al.). Thus, the processing of syntactic structure seems to work hand in hand with the processing of semantic structure, which is in conflict with the above view of how distance and local expressions are semantically combined.

(13)   100 m hoch unter W
(13') (a)   *[$_{PP}$ 100 m hoch unter W]
       (b)   [$_{PP}$ [$_{PP}$ 100 m hoch] [$_{PP}$ unter W]]
       (c)   [$_{PP}$ [$_{PP}$ hoch oben] [$_{PP}$ unter W]]
(13") λx [LOC(x, UNTER*(W)) & QUANT(VERT(DIST'(W, x))) = [0+100]]

A similar problem concerning the relation of structure and content can be found in the **acceptability** of (structural interpretations of) expressions. As for (13), there is obviously no way to understand (13'a) while (13'b) is perfectly good (compare (13'c)). Again, according to the semantic analysis of such combinations as presented in section 2, the different readings cannot be distinguished semantically.

(14) [$_{PP}$ [$_{AP}$ 100 m hoch] [$_{PP}$ über M]]
(15) *[$_{PP}$ [$_{AP}$ 100 m hoch] [$_{PP}$ [$_{AP}$ 100 m tief] [$_{PP}$ über M unter W]]]

While the foregoing points both concerned grammatical structures, one can show that the existing approaches fail to distinguish between grammatical and **ungrammatical** readings, too. As distance and local expressions are both treated as properties of objects, it seems possible and uncontroversial to regard this interaction as distance-APs modifying local PPs (see (14)). However, using this scheme for more complex expressions (that is, recursively for a PP), one may arrive at structures like (15). Although they should turn out as perfect according to the above semantic treatment (note that the situation provides all the information needed for instantiating the relations), these structures are obviously ill-formed. This in turn leads to the conclusion that there is more to the relation of structure and content than has been considered so far in the semantics of distance and local expressions.

3.2 Local prepositions

---

6   For those who do not share the preference assumption the critical point can be generalized: it is not guaranteed that a certain structure maps on the corresponding content, that is, for example, M cannot be excluded from being the second distance point in (12'b); the syntactic difference between (12'a) and (12'b) even seems to be **irrelevant** for semantic analysis.

As has been scetched in section 2, the semantic form of local prepositions is characterized by a localization relation between the located object and the preposition-specific region relative to the reference object (that is, the place of the located object is included in the respective region) (cf. Wunderlich 1982/83, Bierwisch 1988, Wunderlich/Herweg 1990). This conception strongly determines the analysis of distance expressions: Simply note that there is no slot provided for a distance argument, and that there is no object available for a distance modificator either. Thus, in this view there is no other possibility than handling both types of expressions in the way described above: as separate properties to be related by unification of the external arguments. In the following, I want to question this view by emphasizing its **rigidity** and by critisizing the assumption of an **explicit** region argument.

What makes the proposal of Wunderlich and others so attractive? Perhaps the answer can be found in its systematicity: the semantics of spatial expressions appears to be describable within a uniform theory of space that is built on a tight formal basis (a set of spatial points, regions to be constructed as subsets of this set, and operators for region construction; localization as set inclusion). Moreover, the terminology is well motivated: to talk about regions of space instead of the exact places of objects reflects the inherent vagueness in local expressions and apparently is justified by anaphoric references to such regions (cf. *He went into the room. <u>There was</u> ...* where *there* refers back to the interior region of the room as introduced by the directional PP). Finally, there seem to exist languages where this "real" conceptualization of space is verbalized more explicitly. Wunderlich (1990) gives an example for this (shown as (16)) that relates a German local PP with its Japanese counterpart in which the topological region inclusion is grammaticalized.

(16) (a)   über dem Berg   / above the mountain
      (b)   ((yama no) ue) ni
      (c)   ((Berges des) ÜBER-Raum) in   / ((mountain GEN) ABOVE-Region) in

Let me comment on these points in reverse order. First, it is certainly justified to look for linguistic and non-linguistic universals by cross-linguistically comparing grammatical codings of a certain content (as is done in (16)). However, I would doubt that this procedure is of much use for discovering the semantic form of a specific lexical item. Consider, for example, the German expressions in (17). Suppose that we investigate the grammaticalization of nearness and find that it is expressed as 'in-the-proximity' in some language. Does this equal (17b)? What about (17a)? And what if (17b) did not exist in German?[7] Shouldn´t we then believe that *nahe* has to be analyzed as *in der Nähe* ? This, however, is something like $\lambda y\lambda xLOC(x, NAHE^*(y))$, which is quite different from the above proposal! Thus, the characterization of local prepositions by the described localization relation can be <u>motivated</u> <u>cross</u>-or <u>inter</u>-linguistically, but must be <u>justified</u> <u>intra</u>-linguistically at last.

(17) (a)   *nahe*   (b)   *in der Nähe*
            near   in the proximity

Second, vagueness is by no means unique to the local domain as can easily be seen in a comparison with event expressions (see (18)). Similarly, anaphoric reference seems to resemble that in the domain of events (see (19), (20)). Note the differences, however: only in the local domain is the vagueness made **explicit** in the semantic forms of lexical items; on the other hand, only in the event domain do the semantic forms of lexical items have a

---

[7]   Note that one can say *in der Nähe/Weite/Ferne/Höhe/Tiefe* and *im Inneren* but that there are no equivalent constructions for the other prepositions.

referential theta-role that can be used for modification (at least if construed after Davidson). Thus, there are some idiosyncrasies of the current approaches to the analysis of local prepositions that might be questioned in principle. In addition, if anaphors like *there* are taken to refer back (only) to introduced regions, the approaches even suffer from a much more concrete defect: in examples such as (21), the restriction expressed by the distance AP is simply ignored (that is, the whole interior of the forest is referenced).

(18) (a) A: Peter stands in front of the church. B: O.k., but where does he stand <u>exactly</u>?
     (b) A: Peter washes up the dishes.   B: O.k., but what does he do <u>exactly</u>?

(19) (a) Peter did X. Paul did <u>that</u>, too.
     (b) Peter stood at X. Paul stood <u>there</u>, too.
(20) (a) Peter did X. He did <u>that</u> without harming anyone.
     (b) Peter stood at X. He stood <u>there</u> without moving a bit.

(21) We went 200 m into the forest. <u>There</u> we found...

(22) moon in the window, picture in the mirror
(23) knot in the shoelace

Third, while the systematicity of the above account and its benefits for the analysis of local expressions cannot be denied, its underlying **ontological assumptions** deserve attention. Consider, for example, the local preposition *in*. It expresses the containment of the place (of some part) of the located object within some inner region of the reference object. By assumption of the spatial theory scetched above, we may define 'inner regions' and even subclassify them ('material inner region' vs. 'non-material inner region') in order to allow specific inferences (e.g., if the located object is something like a hole, it must be located within a material inner region). So far it seems that we get by on modelling the external world. This is disproven by examples like (22). We therefore need to broaden the theory to include the localization of 'projected objects' within 'regions-for-projected-objects'. Still, this might be possible. However, what is meant by examples like (23) then? Here the assumption of an inner region in which the knot is located must be regarded as unwarranted and utterly post hoc! I presume that even declaring such examples as figurative or the like will only shift the problem (to the criteria of generating or admitting some non-local *in*-phrase). According to this line of argumentation, then, a spatial theory that makes explicit regions of space and tries to ontologically differentiate between them runs into serious problems. One of those might be, in general, the shift from specifying the semantics of a preposition to specifying the meaning of the corresponding region(construction).

3.3 Distance adjectives

In section 2, I have already mentioned that the **argument structure** of distance adjectives is of pivotal importance for a correct analysis of their semantic form as can be easily seen from the conflicting proposals in (1) and (6). I showed that any theory dealing with the adjective *weit* must give an account for its use in expressions like (8): instead of functioning as the endpoints of the distance expressed, the modified nouns in these examples themselves supply a distance that can be quantified. Thus, none of the two proposals for the semantic form of a distance adjective seems to be right. What remains in the face of these data, therefore, is the question of how to avoid polysemy if possible.

(1) distance adjective: $\lambda c\ \lambda x\ [QUANT\ (DIST'\ (y, x)) = [v \pm c]]$

(6)   distance adjective: $\lambda c\ (\lambda y)\ \lambda x\ [QUANT\ (DIST'\ (y,\ x)) = [v \pm c]]$

(8) $[_{NP}weiter\ Weg]$, $[_{NP}weite\ Reise]$, $*[_{NP}naher\ Weg]$, $*[_{NP}\ nahe\ Reise]$
        $[_{NP}far$ way$]$, $[_{NP}far$ travel$]$, $*[_{NP}\ near\ way]$, $*[_{NP}\ near\ travel]$

As   (8)   clearly   shows,   things   are   even   more   complicated.   Nouns   like   *Weg*   and   *Reise*
obviously do not admit the antonym of *weit* , that is, are not compatible with the proposition
that the involved distance is small. This is a phenomenon which has already been noted by
Bierwisch/ Lang (1987b) with respect to event expressions (see their examples in (24)) and
which   also   holds   for   combinations   with   local   particles   and   prepositions   (see   (25a)).   In
contrast to this, just the opposite is true in (25b), where the expression of a great distance is
incompatible with the modified PP (also compare this with (5) and (13) above).

(24) (a)   *Der Gummiball springt hoch/*niedrig/nicht hoch//weit/*nah/nicht weit*
                The rubber ball jumps   high/ *low   /not high   //far/ *near/not far
       (b)   *Der Gummiball springt höher und weiter als der Plastikball*
                The rubber ball jumps   higher and farther than the plastic ball
       (c)   *Der Plastikball springt *niedriger/weniger hoch und *näher/weniger weit als der
                Gummiball*
                The plastic ball jumps   *lower   /less high   and *nearer/less   far than
                the
                rubber ball
       (d)   *Die Kugel drang tief/*flach ein*
                The bullet penetrated deep/*shallow into

(25) (a)   *weit/*nahe weg/über*   (b)   **weit/nahe bei/an*
                far/*near away/above   *far/near   near/at

4.   Perspectives

        After   having   discussed   various   problems   which   the   existing   approaches   to   the
semantics of distance adjectives is confronted with, it should be evident that a satisfying
solution to all of these problems cannot be presented in this paper (if it can be found in near
future   at   all).   Therefore,   what   I   intend   to   do   in   the   following   is   to   propose   a   general
framework of investigation for this restricted lexical domain that on the one hand represents a
partial solution for the mentioned problems and on the other hand provides an orientation for
future research.

4.1 Distance adjectives

        Regarding the argument structure of distance adjectives, there are linguistic data which
have not been presented before but may turn out as crucial for the whole analysis. Compare,
for example, (26) with (26') and (26'') which both can be regarded as nearly synonymous to
it. Although speculation at last, these juxtaposed data justify an analysis that is based on the
following assumptions: (i) there is an empty head in (26) and similar cases; (ii) distance
adjectives are treated semantically not as 'properties of objects to be in a certain distance to
another object' represented as ternary predicates but as 'properties of **paths** to have a certain
extent' represented as binary predicates; (iii) the constituents being modified by a distance
adjective provide such a path (it is therefore the path expressions that subcategorize for a
source PP like *von hier*, contrary to the analysis in (6)).

(26)   *Der Bahnhof ist nicht weit von hier*
            The train station is not far from here
(26') *Der Bahnhof ist nicht weit **weg*** (away)*von hier*
(26") *Der Bahnhof ist nicht weit **entfernt** von hier*

(1*)   distance adjective: $\lambda c\ \lambda x\ [QUANT\ (DIST'\ (x)) = [v \pm c]]$

As has been shown in the discussion of (10), the assumption of an empty head in (i) is also necessary in other constructions and therefore by no means specifically stipulated. (ii) is in line with Bierwisch who writes that "[...] distances to be measured in terms of one-dimensional units like *Meter* must be specified as a path" (Bierwisch 1988:32). Taken together, (i)-(iii) do away with the problems of argument structure in that distance adjectives now syntactically subcategorize for a constituent that semantically provides or allows a path to be modified (see (1*)). This view has two implications at its heels: first, it can be reasonably assumed that some prepositions also provide a path (whatever this may be); second, although still difficult in detail, the differences of **acceptability** in (8), (24), (25) can be described in principle by categorical modifier-head (in-)compatibilities. Thus, this view clears the way for a syncategorematic, non-extensional analysis as demanded in section 2.

4.2 Local Prepositions

In section 3.2 I tried to show that analyzing local prepositions exclusively on one level (i.e., the level of local regions) leads to a number of problems. I argued that it is the assumption of explicit regions which determines some critical properties of the existing approaches. To sum up the criticism, the explicitness is supposed (i) to determine the level of analysis, (ii) to cause rigidity (because of the encapsulation of the region in the LOC-relation; see the problems with respect to anaphoric reference and to modification), (iii) to call for questionable further ontological assumptions, and (iv) to lead to a semantic form that is quite different from those of event expressions.

Now assume that this crucial axiom is abandoned while at the same time more attention is payed to (iv). Taking up this view it can be argued that there seems to be no reason for distinguishing event and local expressions on formal grounds. Both can be regarded as expressing some set of conceptual conditions (albeit of different ontological type) which might be specified (i.e., modified) by another set. With respect to the semantics of verbs, the use of a referential theta role reifying the conceptual conditions has been established to enable a formal treatment of modification. Local prepositions, I want to propose, should be semantically treated in the same way. As a direct consequence, their general semantic representation would be the one in (27). In this representation, r is the referential argument reifying the conceptual conditions abbreviated by the 'LOCALIZE'-parameter that has to be spelled out for each preposition. The use of INST ('instantiates') tentatively follows Bierwisch (e.g., 1988).[8]

(27) $\lambda y \lambda r \lambda x\ [r\ INST\ [LOCALIZE(x,y)]]$

Let us consider what is gained with such a treatment. Above all, explicit local regions are no longer **necessary** ingredients for the semantic recipe of local prepositions as well as there are no explicit 'washing-up-the-dishes'-regions in the semantics of verbs, for example.

---

[8]   It might be necessary to generalize the interpretation of INST for its use in the local domain. Certainly, this is a matter of further research.

Nevertheless it is possible and reasonable to speak of 'the-event-of-washing-up-the-dishes' and 'the-region-of-x-being-located-above-y' due to the existing referential variables. Note that these entities are vague (typically they are!) in the same formal sense, namely, because they can be further specified (e.g., 'the-event-of-washing-up-the-dishes-in-the-kitchen', 'the-region-of-x-being-located-above-y-and-below-z'). There need not be a distinct level of analysis, however, as *above*, for example, might be grammatically coded as (28) in one language, and as (28') in another (compare (16a,c)). The difference is that in (28') the 'above-region' is used as an argument and therefore made explicit in the semantic representation. Similarly, *nahe* and *in der Nähe* can be distinguished intra- or interlinguistically (see (29), (29'), and compare (17a,b)).

(28) $\lambda y \lambda r \lambda x$ [r INST [VERT_LOCALIZE(x,y)]]
(28') $\lambda y \lambda r \lambda x$ [r INST [IN(x, ιr'λz [r' INST [VERT_LOCALIZE(z,y)]])]]
(29) $\lambda c \lambda r$ [NAHE(r,c)]
(29') $\lambda y \lambda r \lambda x$ [r INST [IN(x, ιr'λz[[r' INST [LOCALIZE(z,y)]] & NAHE(r',c)])]]

It can easily be seen that (ii) and (iv) dissolve in this view because the introduced region variable makes modification and correct anaphoric reference possible, and because the semantic representation of local prepositions is construed analogously to that of event expressions. As regards the classification of regions ((iii)), this is no longer (exclusively) a matter of conceptual ontology but (also) of linguistic categorization. Thus, one has direct specification instead of problem shifting, a systematic distinction between conceptually and linguistically determined clusters of conditions[9] instead of an unclear concept 'region', and, finally, one has the distance conditions relating to the localization conditions. This last aspect constitutes the basis for modelling the (in-)compatibilities of local and distance expressions.

4.3   The combinatorics of local and distance expressions

With the proposals made for the semantic representations of distance adjectives and local prepositions, I have set the course for modelling their interaction. From the above presentation, it can be deduced that the general syntactic structure of combinations of local and distance expressions is the one in (30): conforming to the principles of X-bar-syntax, the local expression modified by a distance-AP must be regarded as a non-maximal projection of P, that is, P'. I will use the examples of section 3.1 to illustrate the consequences of this simple insight.

(30)   [$_{PP}$ AP P']

(12)   100 m weit über M
(12') (a)   [$_{PP}$ 100 m weit über M]
       (b)   [$_{PP}$ [$_{PP}$ 100 m weit] [$_{PP}$ über M]]

(13)   100 m hoch unter W
(13') (a)   *[$_{PP}$ 100 m hoch unter W]
       (b)   [$_{PP}$ [$_{PP}$ 100 m hoch] [$_{PP}$ unter W]]

(15)   *[$_{PP}$ [$_{AP}$ 100 m hoch] [$_{PP}$ [$_{AP}$ 100 m tief] [$_{PP}$ über M unter W]]]

---

[9]   For the importance of this distinction, see also Carstensen (1992) and Lang (1991).

With respect to examples like in (12), a **preference** for (12'a) can be explained jointly by the close head-modifier-relationship of the involved constituent and the principles of a parser utilizing this relationship for attachment decisions (in this case, the principles of early semantic integration and theta-attachment; see Hemforth et al. 1992). As for (13), the difference in **acceptability** derives from the semantic incompatibility of *hoch* and *unter*. Note that while (12'b) is a second hand reading, (13'b) is the only acceptable one. Finally, (15) can easily be ruled out as **ungrammatical** because it does not match the schema in (30). In figure 2, the structural assumptions made by the new proposal are illustrated with a slightly more complex example (*100 m weit über dem Meer unter den Wolken*).

100 m weit über dem Meer
unter den Wolken

λx [$\exists r$ [[r INST [ÜBER(x,MEER)]] & QUANT(DIST'(r)) = [0 ± 100]] & $\exists r'$[r' INST [UNTER(x, WOLKEN)]]]

PP

PP   **PP**   unter den Wolken

100 m weit über dem Meer

λx [$\exists r$ [[r INST [ÜBER(x,MEER)]] & QUANT(DIST'(r)) = [0 ± 100]]]

λx [$\exists r'$[r' INST [UNTER(x, WOLKEN)]]]

100 m weit   **AP**   **P'**   über dem Meer

λp [QUANT(DIST'(p)) = [0 ± 100]]

$\lambda r \lambda x$ [r INST [ÜBER(x,MEER)]]

über   **P**   **NP**   dem Meer

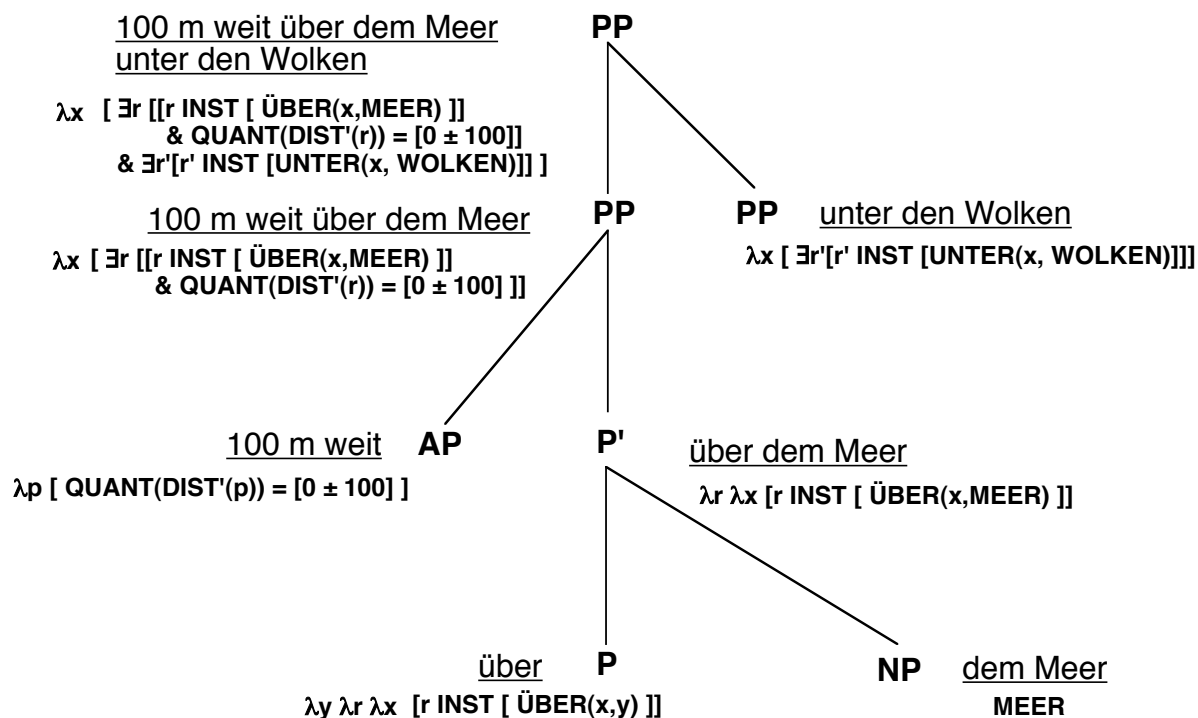$\lambda y \lambda r \lambda x$ [r INST [ÜBER(x,y)]]

MEER

figure 2

Conclusion

In this paper, I showed that existing approaches to the semantics of distance expressions (and also of local expressions) face a number of serious problems. I then presented a general framework which on the one hand indicates how some of these problems can be eliminated and which on the other hand – as a perspective – may serve as a guide for further work to be done in this area. Regarding the former aspect, some drastic changes in the argument structures of adjectives and prepositions have been proposed which led to a better understanding of their semantic and syntactic interaction. As for the latter aspect, I have deliberately left out, for example, questions pertaining to conceptual structure (e.g., what are the conceptual conditions underlying the differences between prepositions) and linguistic categorization (how are conceptual conditions grammatically coded in different types of expressions, e.g., local prepositions and adverbs, directional prepositions, and distance adjectives; how are they coded in specific lexical items). As a byproduct of colouring these white areas of research, one may come to an understanding of the as yet unexplained (in-)compatibilities. Only then will the whole story of the semantics of distance adjectives have been told.

References

Bierwisch, M. (1983): "Semantische und konzeptuelle Repräsentationen lexikalischer Einheiten". In: R. Ruzicka / W. Motsch (Hrsg.): *Untersuchungen zur Semantik*. Berlin: Akademie-Verlag (Studia Grammatica 22). 61-99.

Bierwisch, M. (1988): "On the Grammar of Local Prepositions". In: M. Bierwisch, W. Motsch, I. Zimmermann (eds.): *Syntax, Semantik und Lexikon.*. Berlin: Akademie-Verlag (Studia Grammatica 29). 1-65.

Bierwisch, M./ Lang, E. (eds.)(1987a): *Grammatische und konzeptuelle Aspekte von Dimensionsadjektiven*. Berlin: Akademie-Verlag. (Studia Grammatica 26/27).

Bierwisch, M., Lang, E. (1987b): "Etwas länger - viel tiefer - immer weiter: Epilog zum Dimensionsadjektiveprojekt". In: M. Bierwisch/ E. Lang (1987a), 649-699.

Carstensen, K.-U. (1992): "Finding Adequate Routes for the Generation of Route Descriptions". In: G. Görz (Hrsg.), *KONVENS 92. 1. Conference "Processing of Natural Language"*. 309-318.

Habel, C. (1989): zwischen-Bericht. In: C. Habel /M. Herweg / K. Rehkämper (Hrsg.): *Raumkonzepte in Verstehensprozessen. Interdisziplinäre Beiträge zu Sprache und Raum*.Tübingen: Niemeyer. 37-69.

Habel, C./ Pribbenow, S. (1988): *Gebietskonstituierende Prozesse*. LILOG-Report 18. IBM Stuttgart.

Hemforth, B./ Konieczny, L./ Scheepers, Ch./ Strube, G. (1992): "SOUL-Processing: Semantik-orientierte Prinzipien menschlicher Sprachverarbeitung". In: G. Görz (Hrsg.), *KONVENS 92. 1. Conference "Processing of Natural Language"*. 198-208.

Herweg, M. (1989): "Ansätze zu einer semantischen Beschreibung topologischer Präpositionen". In: C. Habel /M. Herweg / K. Rehkämper (Hrsg.): *Raumkonzepte in Verstehensprozessen. Interdisziplinäre Beiträge zu Sprache und Raum*. Tübingen: Niemeyer. 99-127.

Higginbotham, James (1985): "On Semantics". *Linguistic Inquiry* 16 (4). 547-593.

Lang, E. (1987): "Semantik der Dimensionsauszeichnung räumlicher Objekte". In: M. Bierwisch, E. Lang (eds.)(1987). 287 - 458.

Lang, E. (1991): "Linguistische vs. konzeptuelle Aspekte der LILOG-Ontologie". In: G. Klose, E. Lang, Th. Pirlein (Hrsg.): *Die Ontologie und Axiomatik der Wissensbasis von LEU/2*. IWBS Report 171. IV.

Maienborn, C. (1990): Position und Bewegung: Zur Semantik lokaler Verben. IWBS Report 138. Stuttgart: IBM Deutschland GmbH.

Wunderlich, D. (1981/82): "Sprache und Raum". *Studium Linguistik* 12 1-19; 13, 37-59.

Wunderlich, D. (1990): "Ort und Ortswechsel". *Zeitschrift für Literaturwissenschaft und Linguistik* 78. 43-58.

Wunderlich, D./ Herweg, M. (1990): "Lokale und Direktionale". In: A.v.Stechow/ D. Wunderlich (Hrsg.), *Handbuch der Semantik*.

Wunderlich, D./ Kaufmann, I. (1990): "Lokale Verben und Präpositionen - semantische und konzeptuelle Aspekte". In: S. Felix/ S. Kanngießer/ G. Rickheit (Hrsg.), *Sprache und Wissen*. Opladen: Westdeutscher Verlag. 223-252.