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Some notorious pitfalls in the analysis of spatial expressionsⁱ

1. Introduction

Space and time are two equally fundamental categories of human cognition, and it would be very surprising, indeed, if they had not found rich expression in human language. All natural languages we know of show elaborate means to express temporal and spatial relations. These means include, for both categories, the inherent lexical content of words, inflectional marking, adverbials, prepositions, various complex syntactic constructions, and principles of text organisation (such as, for example, the "principle of natural order": Temporal order of mention corresponds to temporal order of events). What is different for time and space, though, is the extent with which the linguistic tradition has dealt with them. Whereas the expression of temporality has been continuously and systematically investigated from the Greek over Priscian and the Junggrammariarians to Montague, there is much less comparable work on "spatial reference", as I shall say here as a shorthand term for all types of spatial expression. This asymmetry is probably due to the fact that at least in Indoeuropean languages, temporality is regularly grammaticalised in verb morphology. Every finite verb carries tense, and hence, reference to time is obligatory (and not very functional since redundant) in all sentences with a finite verb. This is not the case for spatiality. Even where the expression of space is to some extent grammaticalised, for example by case marking, it is hardly ever obligatory.ⁱⁱ This relative neglect of spatiality does not mean, of course, that studies on space and its reflection in human language were absent in the linguistic tradition. But it is only some twenty years ago that it started to excite more than casual interest, and it is quite telling that this increasing interest is found less among structural linguists but among researchers who are more concerned with the interrelation of language and other aspects of human cognition - in psycholinguistics, cognitive anthropology, artificial intelligence. Despite the considerable progress which has been made especially in the course of the last ten yearsⁱⁱⁱ, it is probably fair to say that research on spatial reference is still in the cradle, especially when compared to what has been done on temporality. This applies to very specific problems, such as the semantic analysis of spatial terms within a particular language - what do words such as on, at, by mean, when compared, for example, to German an, auf, bei? - as well as to issues of a more general kind - what are the organising principles behind the expression of spatiality, how do spatial expressions fit into the compositional structure of sentences, etc? None of these questions will be directly addressed, let alone answered, in this paper^{iv}. Its aim is a more modest one. In the next section, I will give a necessarily very general survey of the wealth of problems involved in the analysis of spatial reference. There are so many

interacting components that it seems hopeless to attack the problem in its entirety; the most reasonable procedure to deal with these problems is to start with very simple cases. In doing so, there is however a number of potential pitfalls which are often stepped in - surely not by everybody, but sufficiently often to deserve some discussion, to which I will turn in section 4. They concern (a) the non-separation of object and place of object, (b) the role of so-called directionals, and (c) the relative neglect of spatial expressions without objects being involved. Finally, it is argued that these problems can be avoided by what may be called the property-of-place analysis of spatial reference. This analysis is briefly sketched in the last section of this paper.

2. The range of problems

Traditional wisdom as well as most recent research regularly distinguishes between two basic types of spatial reference, mostly termed "static" vs. "dynamic" (terminology varies, but the basic distinction is the same). Typical examples are (1) and (2), respectively:

- (1) The cup was on the table.
- (2) The cup fell onto the table.

The first sentence describes some spatial arrangement which is claimed to apply throughout the time for which this claim is made -here some unspecified time in the past. This does not exclude that the cup was moved there, nor that it will leave this position again. But for the time at issue, no such claim is made: the arrangement is static for that time. The second sentence makes an explicit claim about such a movement. This is not only reflected in the verb, here walked in contrast to was, but also in the choice of a particular preposition, here onto vs. on. The object, here the cup, follows some trajectory, a **path**, as is most often said, which ends up on the table, and this path is expressed by the verb of movement (or of motion) together with the **directional** preposition onto. Most researchers assume that expressions like (1) are in a way more basic in their semantic structure, because everything needed for the description of (1) is also needed for the description of (2), but not vice versa: the latter also requires some notion of path and/or direction. This is not unchallenged, but we shall follow the general line here and ask, what is indispensable for the semantic analysis of (1), and what then has to be added for dynamic cases such as (2).

If (1) is uttered upon some occasion, then three conditions must be fulfilled, if the listener is to understand it:

1. Referential domain: Speaker and listener must have have the same, or at least a sufficiently similar, representation of the domain of reference, i.e., of space.
2. Linguistic meaning proper: Speaker and listener must know the language-specific meaning of the various spatial expressions used.
3. Contextual integration: Speaker and listener must be able to integrate "linguistic meaning proper" and contextual information of various types.

None of these conditions is trivial, neither for speaker and listener nor for the researcher who wants to analysis their functioning. Linguistic research tends to focus on the second task, the analysis of linguistic meaning proper, and to neglect the two others. In what follows, I shall briefly comment upon these conditions and try to show why no sensible analysis of spatial reference is possible without considering all of them.

Structure of space

The notion of **space**^v which underlies (1) and (2) is what one might call "normal perceptual space" - that kind of space which underlies our everyday perception and action, when we see this and that, hear this and that, move from here to there. Such a space is assumed to consist of smaller entities ("places"), for which a twofold structure is defined: There are three dimensions (vertical, horizontal, transversal, or up-down, left-right, front-back), and there are topological relations, i.e., a place can be (partly) contained in some other place or in the neighbourhood of some place.^{vi} It is this structure which is reflected in the meaning of spatial terms such as on vs. under, beneath above, in vs. out, near, around, left vs. right, etc. But it is easy to see that not all usages of spatial terms operate with this type of space. I give some simple examples:

- (3)(a) Sparta is in Greece.
- (b) Sparta is on the Peloponnes.
- (c) Sparta is not on the map.
- (d) I can't get this idea out of my head.
- (e) I can't get this idea out of my mind.
- (f) I can't get this girl out of my head.

Would we say that Sparta is in the same way contained in Greece as, say, the coffee is contained in the cup? In other words, does geographical space have the same structure as immediate perceptual space? Probably not: We would not assume that Greece is in the same way a three-dimensional entity as, for example, a cup. Why do we say then that Sparta is on the Peloponnes - surely no less and no more a three-dimensional entity than Greece? Or are these different notions of Sparta, a two-dimensional and a three-dimensional one? Such a possibility is supported by usages as in (3c): Here, we are talking about a two-dimensional representation of Sparta on a two-dimensional map. Hence, the underlying space is somehow a conceptual reduction of "real" three-dimensional space. But if this is true, why does one then say on, as in (1)? Is the idea in (3d) a three-dimensional entity, contained in another three-dimensional entity head? This seems possible for the head, less so for the idea? Ideas are generally not assumed to

have a dimension, let alone three. But how is this in (3e), where neither idea nor mind are usually considered to have dimensions? But even if the entities at issue are normally understood to be three-dimensional, like girls, spatial relations can be stated between them which show that we often do not mean them to have three-dimensions, as is illustrated by (3f).^{vii} In other words, "normal perceptual space" is surely an important type of space, maybe even the most important one for spatial reference. But it is no less sure that it is not the only one which underlies the use of in fact quite normal and simple types of spatial reference.

The existence of various types of space is not the only problem. Imagine you are flying from Egypt to Germany, and just above Greece, a friendly pilot explains the scenery:

(4) Greece is just beneath us. The big island beneath Greece, slightly to the right, is Crete, and the little white spot behind Crete is another island called Karpathos.

Clearly, beneath in the first and in the second sentence mean something very different, because beneath Greece in the first sense, there is only the Hades. Somehow, the definition of the dimensions has changed, and so it has from the second to the third sentence. In other words, we not only have different concepts of space but can also easily **switch** from one to the other within a coherent piece of discourse.

These few observations leave the linguist with two basic questions: (a) How should one characterise the various concepts of space which underly the meaning of spatial terms, and (b) How are they related to each other? Most work on spatial expressions so far is concerned with very basic arrangements in "normal perceptual space", and the two tasks have hardly been tackled. In a way, this is understandable, because the analysis of spatial representation in the human mind seems somewhat the realm of linguistic research in the usual sense of the word. But without such an analysis it would seem hopeless to specify the meaning of spatial terms and their use in concrete utterances. I think a realistic solution to both problems must indeed start with some notion of "basic space" and then study various transformations of this basic space: It can be reduced by dropping one or two dimensions, it can be enriched by metrical structure (not found in all cultures), etc. I also

think that the most reasonable candidate for this "basic space" is indeed the notion of space which underlies examples such as (1) or (2), hence simple spatial constellations between three-dimensional objects. But in proceeding so, one is easily trapped, a point to be returned to shortly.

Semantic content

The second problem is the language-specific meaning of spatial expressions. This problem naturally divides into two sub-tasks. First, we must specify the lexical meaning of elementary expressions, for example as prepositions like in, on, under, beneath, behind, between, past, near, adverbs such as here, there, to the left, anywhere, yonder, of motion verbs, sometimes of case marking, etc. Second, we must somehow describe how these elementary terms are integrated into larger constructions, such as in The second book on the upper shelf to your left comes from Japan. It is these two tasks linguists normally focus on. But it would be an exaggeration to say that the problems are solved. I will mention but one, the seemingly infinite polysemy (or perhaps homonymy) of spatial prepositions such as in or on. Examples such as (1), (3b) and (3c) illustrate the point, here for on, and rather than quoting other examples, I refer the reader to what is said about on, in, at, under in (!) any comprehensive dictionary of the English language - an illuminating and sometimes discouraging experience.

A linguist, in contrast to a dictionary maker, cannot be satisfied with listing the various usages and give illustrative. Somehow, they have to be related to each other in a systematical way. I think the only method of doing so is to start with something like a "core meaning" and to study the various cognitive operations which lead to many particular usages. And again, it seems intuitively most plausible to take simple arrangements such as (1) or (2) to represent of the core meaning, here of on - with all the risks this may have.

Context-dependency

It has often been noted that many spatial terms are context-dependent, for example here vs. there, left vs. right or front vs. back. Their meaning is systematically related to the position of the speaker or addressee, or to the position of some other entity mentioned in context. Thus, here means something like "place which includes the position of the speaker", and there means something like "place which excludes position of the speaker"; left, right, front, back not only depend of the position of the speaker but also on his direction of gaze. Not all languages make use of this type of structural context-dependency for spatial reference. Thus, most Mayan languages lack terms for left and right (Levinson 19xx, Havilland 19xx). This does not mean, though, that their speakers have a different representation of space. They had probably died out for long if they did not distinguish whether the jaguar is to the left or to the right. They just do not use their body orientation to describe these sub-spaces. Where use is made of spatial deixis and of spatial anaphoricity, its exact functioning can be very complex, and has been the subject of much research (see, for example, the papers in Klein and Weissenborn 1982, Ehrich 1992).

There is a second, more global type of context-dependency which plays a substantial role for spatial reference. The interlocutor's understanding of here in a concrete utterance not only depends on his ability to identify the position of the speaker but also on his general world knowledge. This is best illustrated by familiar examples such as I cannot see you from here vs. Computers are much more expensive here than in the US, where the boundaries of what is referred to by here are very different.

This "global context-dependency" also solves part of the apparent polysemy in prepositions such as under. Compare, for example:

- (5)(a) The old couple was sitting under an oak tree.
- (b) The mole was living under an oak tree.

Clearly, the old couple is not in the same spatial relation to the tree as the mole, although this relation is in both cases labelled under. It is not the lexical meaning of this word but our knowledge of old couples, on the one hand, and of moles, on the other, which tells us what

exactly the spatial configuration is.

Hence, what the linguist should do is to sort out what the "lexical meaning proper" of such a term is, and what comes from context. Again, it would not suffice to say that contextual information plays a role - this is correct but trivial - but show what the principles are according to which linguistic information proper and contextual information interact in a given utterance to yield a consistent and meaningful interpretation.

In this brief tour d'horizon of the various components involved in spatial reference, we could only touch upon the major factors which play a role in its functioning. All of them are important, and the examples given above are surely not far-fetched. Now, it would seem hopeless to deal with all of these problems at once, and just as in other domains of scientific investigation, I think it is in the one hand important to be aware of the entire complexity of the problem at hand, and on the other to start with what one might consider the most elementary and "prototypical" cases. As many other researcher, I would assume that the best starting point are indeed simple configurations such as described by (1), and then extend the analysis systematically to other, more complex cases. But this procedure, reasonable as it is, has its pitfalls, some of which will be discussed in the following section.

3. The simple case traps

Consider again a simple static spatial description such as (1), repeated here:

(1) The cup was on the table.

The analysis which suggests itself is this: In such a locative description, reference is made to an object, here a cup, and it is said that this cup is in a particular spatial relation to another object, the table; this spatial relation is expressed by the word on, in contrast to, for example, spatial relations as expressed by under, behind, above etc. Languages differ with respect to the spatial relations which they encode, and also in the way, in which these spatial relations are encoded.

I think this picture has the seductive charm of all simple accounts; but it is a strong and in fact misleading oversimplification. Its first pitfall is the fact that it does not sharply distinguish between objects and the place of objects in local expressions. There are (at least) three arguments which necessitate such a distinction:

The time parameter argument

Consider a sentence like (6):

(6) Peter is sitting exactly where Mary was sitting yesterday.

Such a sentence is entirely ununderstandable unless we assume that there is some entity different from Peter and Mary - a certain place, say place L. What (6) says, is simply, that at some time, namely right now, L is occupied by Peter, and at some other time, namely yesterday, L was occupied by some other entity, Mary. It is L which remains constant, whereas the objects (here: persons) which are at this place change. A somewhat more circumlocutional way to state (6) would be:

(6)' The place where Peter is sitting now is identical to the place where Mary was sitting yesterday.

The question whether there is a space, and hence individual places, independent of objects being there is an old and highly controversial philosophical issue, which we surely do not want to comment upon here. But it appears that the way in which people talk about space requires a clear distinction between places and objects. I simply see no way how else the meaning of (6) could be described: We must assume that there is some constant entity, a place, irrespective of the objects which temporarily occupy it.

The change-of-place argument

In (6), the place is kept constant, and it is successively occupied by two different entities: first Peter, then Mary. The exact counterpart is a situation in which the object is kept constant in an utterance and two places are involved. In fact, utterances of this type are extremely common: it is all those which involve a change-of-place expression or, to use the more common term, a movement expression, as in (2) or in the following two examples:

(7) John came from Alabama.

(8) John went to Louisiana.

In (7), the place where John first is is "in Alabama", and the place where he is thereafter is not specified in the utterance; it is only clear that it is not in Alabama. The same is true for (8), except that here, only the second place is specified (IN-Louisiana) and the first place is left open (NOT-IN Louisiana). We may conveniently call the first place and the second place in these change-of-state expressions, "source place" and "target place", respectively. Then, the meaning of (7) and (8) can be made more explicit by the following rough paraphrases (details aside):

(7)' The source place of John is IN-Alabama, and the target place of John is NOT-IN Alabama.

(8)' The source place of John is NOT-IN Louisiana, and the target place of John is IN-Alabama.

I do not want to say that these paraphrases are communicatively appropriate; they only render the semantic structure more explicit.^{viii}

Three additional remarks on this point:

(a) Under this analysis, change-of-place expressions are just a special case of "change-of-state" expressions in general, such as, for example, to close a window or to die. A verb such as to die involves a first state in which the argument, say John, is not dead, and a

second state, in which he is dead. Here, some "qualitative properties" of John is at issue, whereas in come and go, the two distinct states are characterised by two different places.

(b) An utterance with a target state (in particular, target place) need not say that this target state/place is in fact reached - either at all, or within the interval considered. Thus,

(9) John was walking to the station.

does not imply that he ever reached the target place (AT-station); still, AT-station is the target place. The situation is exactly as in non-spatial utterances like (10):

(10) John was baking a cake.

Clearly, the "target state" involves that there be a cake, due to John's efforts. But (10) does not imply that this target state is ever reached within the interval about which (10) makes a claim. It is simply left open.

(c) So-called "directional expressions" such as into, onto vs. in, on or German in + Acc. vs. in + Dat. **never** denote a direction. They simply mark a place to be a target place (or, less frequently, to be a source place, such as from, or even rarer, to be an "interim place", such as via or German über). Nor do they denote a "path" or a "trajectory". Consider again (7): Depending on where John was before (i.e., depending on his source place, not made explicit in this utterance), the "direction, path, trajectory" is very different, and (7) does not say anything about them: It only says that his target place is IN-Louisiana. This is not to deny that it is possible to express directions or trajectories or paths. But that is not the function of what is commonly called "directionals".^{ix}

The non-object argument

As Wittgenstein once put it: Our reasoning often suffers from an unbalanced diet of examples. I think that linguistic reasoning on spatial reference is a good example: they are strongly biased by some properties of the "prototypical" constellation, i.e. by utterances which involve three-dimensional objects localised in three-dimensional space. In fact, spatial expressions need not localise objects at a particular place. Consider the following simple examples:

(11) Kant is famous in Spain.

(12) The final will be played at the Meazza stadion.

(13) It is too hot under the roof.

These examples are perfectly normal spatial expressions, definitely no exotic cases. But we cannot say that they localise an object (or person) at some particular place. Kant is perhaps an object^x, and he is referred to in (11). But he was never in Spain, nor is this said by (11). What (11) says, is rather that the place, or perhaps one of the places, where Kant is famous is such-and-such a place. This is even clearer for (12). Only under a very liberal interpretation of the notion "object", we might say that a final is an object. Even under this assumption, (12) does not say that this highly abstract object is localised at the Meazza stadion. It rather says that the place where the final will be played is a place of a certain kind. And finally in (13), there is no object at all, that would be localised, or would stand in a spatial relation to the roof. Or should we assume that by (13), some event, the too-hotness, is said to be lower than the roof? What (13) means is something like that a particular place, an UNDER-the-roof-place, has a certain property, namely that it is quite hot there. Or compare examples such as (14) and (15):

(14) In München, there is a Hofbräuhaus.

(15) In München, it was really chilly.

It makes some sense to say that the Hofbräuhaus is located in the interior space of München. But in (15), the spatial relation seems, if anything, to be rather the opposite: München is spatially included in the chill (or chilly area), rather than the chill in München

(this point was first made in von Stutterheim 1991).

What is the lesson to be drawn from the discussion in this section? We said that is reasonable to start the analysis of spatial reference by studying simple cases such as (1) - the localisation of objects in physical space. But the suggestive notion that utterances of this type simply refer to two objects and specify the spatial relation, here on, between them, is very misleading. The semantic form of spatial reference must be somewhat more abstract, if it is supposed to cover the various facts mentioned in this section. What can this general semantic form be? In the concluding section, I will briefly address this question.

4. The "property of place"-analysis of spatial reference.

Consider once more (1). Under the assumption, justified above, that what we are dealing with is not just the cup but the **place** where the cup is at some time, (1) can be paraphrased as follows:

(1') The/a place where the cup was (at some time in the past) was (at the same time) an ON-place of the table.

What an ON-place of the table is, depends on how exactly the lexical meaning of English on is analysed; we can assume, for present purposes, that ON-places of the table are all those places which are higher than and in contact with the place where the table is. This analysis easily extends to the other cases discussed above. Consider, for example, (11) - (13). In these cases, the defining property of the places at issue is not the fact, that an object is there, but the fact, that, for example, Kant is famous there:

(11)' The/a place where Kant is famous is IN-Spain.

(12)' The/a place where the final will be played is AT-Meazza stadion.

(13)' The/a place where it is too hot is UNDER-roof.

In all of these examples, only one place is at issue, which is then further characterised as a place of a particular type. How about so-called directionals, as in (2), repeated here:

(2) The cup fell onto the table.

As was said above in connection with examples (7) and (8), I do not think that onto expresses any direction, nor does it involve a "path", as is often assumed in the literature. Utterance (2) simply says firstly that the place at issue is an ON-place of the cup, and secondly, that it is a **target place** (in the sense explained above). In this particular case, there is indeed some directionality involved. But this directionality stems from the lexical meaning of to fall: it involves movement according to gravity. But consider (7), where the movement verb is to come. All it says is that the target state of John's activity is an IN-place of Louisiana. No path, and no direction whatsoever, are described. Many paths lead to Louisiana, all of them compatible with (7). This applies accordingly to (8), except that here, it is the source place, rather than the target place, which is at issue.

Under the present analysis, the prototypical spatial arrangement of two three-dimensional objects, such as exemplified by (1), is just a special case of spatial expressions: What is at issue, is not the/a place where, for example, Kant is famous at some time, or where it was too hot, or where John is striving for to be, but the place where, for example, a cup is at some time, and it is said that this place is a such-and-such place - for example a place which is higher than and in contact with the place where some table is at that time. This is not to deny that in (1), **reference** is made to the cup, and not, at least not directly, to the place where the cup is at that time. But the **predication** does not specify properties of the cup as such, like its being made of China, or yellow, or half-broken, or ugly, but of the place which it occupies at some time.

The general scheme of a spatial expression sketched here does not solve the many problems mentioned in section 2. What it allows, I think, is to start indeed with very simply

cases, such as (1) or (2), to determine the role of the various components - representation of space, meaning of simple and complex expressions, integration of contextual information - and then to extend this analysis successively to other, more complex or simply more abstract ways in which spatial information can be expressed in natural language.

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Notes

ⁱ. Some of the ideas outlined here were presented at a conference organised by IBM Germany in Dresden, June 1992. I wish to thank Helmut Schnelle for a very instructive discussion after the talk. I am also grateful to my colleagues from the project "The expression of time and space" at the MPI für Psycholinguistik, Nijmegen, notably Manfred Bierwisch, Melissa Bowerman, and Veronika Ehrich, for many helpful discussions. Many thanks, too, to Steve Levinson and Dieter Wunderlich. None of them should be held responsible for my views.

ⁱⁱ. It is possible, though, that spatiality is deeper rooted in the structure of sentences than would seem at first glance, an assumption which gives rise to so-called "localist theories". There is, for example, the old notion that all cases are derived from locatives (see, for example, Wundt 1904, chapter 6, section II). Even if this were true, it would not mean that any case marking now serves to express space, and hence the expression of space would be an obligatory category. For a recent discussion of localist theories, see Wunderlich and Herweg (1992), section 5.

ⁱⁱⁱ See Wunderlich and Herweg (1992) for a good survey on the linguistic research; Hermann (1990) is representative for recent work in experimental psychology; Levinson (1992) for cognitive anthropology. There is a whole series of edited volumes, such as Jarvella and Klein (1982), in which spatiality is discussed from various points of view; Weissenborn and Klein (1982) gives some idea of crosslinguistic variation; the state of the art is perhaps best represented by the contributions to Habel et al., eds. (1989).

^{iv}. More details on my views are to be found in Klein (1990), (1991). For a critical assessment, see Wunderlich (1990).

^v In contrast to the linguistic analysis of space and its expression, the philosophical tradition is long and rich. The most comprehensive survey is Gosztanyi (1976). It is interesting, though, that in this long tradition, all sorts of arguments show up, physical, psychological, anthropological, even theological. But philosophers seemed hardly ever interested in the ways in which people **speak** about space in everyday language.

^{vi} All of these notions can be made more precise, see, for example, Wunderlich (1982) or Klein (1991).

^{vii} I should point out here that it is no answer to say that this usage is "metaphorical". This may be correct or not, but even if it is orrect, it does not say anything: It encapsulates a mystery by a word, like an intruder in a bee hive. this is a strategy we often find in science, for example in the medical sciences where unexplainable observations are sometimes covered by the expression "placebo effect", thereby hiding the fact that these observations are simply a mystery.

^{viii}. No one would normally speak this way, and hence, the paraphrases are no **communicatively** appropriate versions of the original examples. They only render the semantic structure more explicit. Since this point was occasially cast into doubt, it might be helpful to illustrate it by a more familiar example. No one would deny that in

(i) The old man shaved himself.

the word himself refers to the same person as the expression the old man. Hence, the semantic structure of (i) is something like

(i)' That person who is the only old man in the given context shaved that person who is
the only old man in the given
context.

But it is not very likely that such a paraphrase is understood by anybody except a linguist in the sense of (i).

^{ix} This idea is very much at variance with what is commonly assumed about dynamic spatial reference, in which notions such as "path", "directionality" etc. play an important role. The only exception I know of are Wunderlich and Kaufmann (19..) and Kaufmann (1990).

^x I say "perhaps" because it is not clear in (11) whether Kant as an physical entity is at

issue here or rather something like his achievements, his ideas, his philosophy, which one would not so very much consider to be an object (in the sense in which a cup is an object).