INTERNATIONAL COMPUTER SCIENCE INSTITUTE

1947 Center St. • Suite 600 • Berkeley, California 94704-1198 • (510) 643-9153 • FAX (510) 643-7684

Towards a cognitively based approach of a description of spatial deixis

Matthias Kaiser

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Abstract

In this presentation an approach towards a description of spatial deixis based on the perceptual and cognitive abilities of humans is outlined. After a basic introduction into space perception and representation the findings of this part are taken to form the basis for a characterization of the phenomenon of deixis as well as the conceptual components of deictic expressions in a natural language. For the analysis of deictic expressions a cross-linguistic view is applied to find on the one hand universal components of those expressions but also a number of potentially influencing factors. The goal is to find features that may be components of deictic expressions and thus must be considered in a general model of spatial deixis which can serve to classify and describe the meaning of spatial deictic expressions in any natural language.

1 Introduction

Deixis is the name given to those formal properties of utterances that can be interpreted only properly in respect to a given (known) context reflecting contents of a discourse or a physical setting. This context supplies parameters for the instantiation of the formal properties by the operation of variable binding. In other words, deixis is the name given to uses of items in categories of lexicon and grammar that are controlled by certain details of the interactional situation in which the utterances containing those items are produced (Fillmore 1982). This means that deictic utterances contain language items having the function of variables that must be bound by the receiver of the utterance using his/her knowledge about the particular situational setting or general knowledge to instantiate the variables given in an utterance, thereby making it a referential statement.

We can distinguish three subclasses or dimensions of deixis according to the semantic categories of the utterance components that are expressed by deictic expressions:

- spatial deixis, typical spatial deictic expressions being **here, there,** but also under certain circumstances prepositions like **left, right** etc.
- personal deixis, typical personal deictic expressions being **I, you, her** etc
- temporal deixis, typical deictic expressions are **now, then, yesterday etc.**

(Sennholz, 1985, 70)

As can be seen from the title of this paper, Here only the spatial dimension of deixis is of major interest.

There are two aspects of deixis that constitute the notion:

- How do we perceive and recognize, represent and judge situational phenomena which form the basis for the anchoring of a communicative act and thereby motivate the form or give material for the interpretation of the utterance that manifests that act (Fillmore, 1982)? The question to ask here is: how succeeds a speaker in using his/her current situation for the anchoring of a communicational act? What are our cognitive abilities to perceive and represent space?
- Which lexicogrammatical means do we have to encode context sensitive anchoring of communication acts? What are the means in a natural language we use to talk about our representations of spatial features?

In respect to these two aspects of deixis two strategies for the research of deictic phenomena are possible:

- research in the cognitive domain to find out the nature of perception and representation and make predictions about what a language must therefore be able to account for
- investigation of linguistic entities and phenomena and draw conclusions about the nature of the underlying cognitive processes

Although language is based largely on abstraction from perceptual entities in their concreteness it must operate within the constraints imposed by the way the perceptual system works in order to effectively communicate about perceptual experiences. An advantage of the approach from the perceptual direction is that there is less cultural influence as it is in language which makes it hard to find real universal phenomena.

According to the two aspects of deixis and my preference of the approach from the cognitive side the following disposition for this paper emerges:

First I will turn to a brief discussion of some of the most important perceptual and cognitive features for the representation of space to shed some light on the question how we represent certain features of space to be able to give more satisfactory answers to the question how language utterances which denote such spatial features can be understood and even more, which features we communicate by the usage of language. At the end of this part I will give a general cognitively motivated characterization of the phenomenon of spatial deixis.

Then I try to show what spatial deictic expressions can talk about in a natural language. I will discuss a number of examples for different phenomena within the domain of spatial deixis. My goal is to find meaning components of spatial deictic expressions that can serve to classify them into subclasses which are of a universal kind. Therefore I have to certain deictic expressions in some languages from those that seem to be found in deictic expressions in any language.

At the end I will provide a short summary and some remarks about my findings outlined here.

2 Some perceptual and cognitive abilities of space recognition

There are three major components that determine our spatial representation and interaction and so our language communication about space since this is based on conceptual representations that are the result of what we perceive, how we represent it and how we can interact with it (Langacker, 1987):

- perceptual systems (visual, auditory, haptic)
- motor systems (ability to move the body and body parts)
- mental representation (conceptualization of perceptions)

Of course I can not deal with these components here in detail at all; Only some features that are of great importance will be mentioned here very briefly since they determine to a major degree the way we talk about spatial events. I want to show that our perception and thereby also our representation of space is crucially depending on the way our body can get information and interact with the world according to our senses, our size, strength etc.

2.1 Function and features of the body axes

One of the most critical question regarding perception of space is how we perceive the three dimensions of space (up-down, front-back, left-right) because these axes make up a

coordinate system that allows the location of objects in space with respect to the human body and thereby is an important presupposition for the description of spatial phenomena using a natural language. Questions to ask here are:

- What is the organ of perception of a dimension?
- What are properties of these dimensions, how do we interact with them?

As I just said, the basic means we use to recognize spatial features is a three-dimensional coordinate system constituted by the following body axes:

- head-feet as vertical axis
- front-back I will call the observer axis
- left-right which I will call the horizontal axis

By the help of this coordinate system we can locate objects or events relative to our body which forms the center of this coordinate system. Our perception of the three-dimensional space around us is crucially determined by the quality of the perception of each dimension and within this of each direction of the dimension. These directions up-direction vs. down-direction in the vertical dimension, front-direction vs. back-direction in the observer dimension and left-direction vs. right-direction in the horizontal dimension. The qualities of the different dimensions/directions are determined by the asymmetries of the human body and the resulting perception and the differing abilities for the interaction with a certain dimension/direction in space. This is an essential criterion for the representation of space in a mental model.

The most important axis for us is the vertical axis (head-feet-axis). Our orientation according to this axis is provided by the organ of equilibrium being sensitive to the field of gravitation of the earth. This means that this axis is always fix, pointing to the earths center and can be perceived everywhere within terrestrial space. This axis is independent of our bodily posture, in the normal posture of perception it alligns to the head-feet-direction. It is also important to note that we are not able to move along this axis (at least not without technical help).

The observer axis (or front-back-axis has its origin in the eyes and is determined by the line of sight. Therefore it is, unlike the vertical axis, not fix but rather flexible, depending on where we direct our sight and thereby our face or our front side of the body (hence front-back-axis). To be precise the observer axis is flexible in two ways:

- it has a flexible position of origin in space because of the ability of motion of the human body and thereby the eyes.
- Because of our ability to move our body it also can be directed to allign with every axis in three-dimensional space (including the vertical). Because this axis is the one allowing depth perception it serves as determiner for front and back sides of objects in a deictic way as I will show later. The observer axis is in the default case 90 degree orthogonal to the vertical (upright posture). We move along this axis in space.

The third axis, the one I referred to as left-right axis or horizontal axis is not an axis of anatomical predisposition as the observer axis and the vertical for which we have organs that determine and perceive it, respectively. Rather this axis is derived from the other two axis and dependent on them, serving as additional means for more precise determination of spatial positions. There may be more than only dependency on the other two axes as a support for the development of left-right symmetry of our body (through ears, arms, legs) although they do not determine an axis as the eyes do because of the linear flow of light. This axis does not have an origin in the sense of those of the other axes (therefore often mix up of left and right but never between front and back or up and down).

The different relevance of the axes which arises from their different features as outlined above plays an important role for the cognition of space and consequently for the means a natural language provides to talk about spatial features. One such consequence might be that we might have in a language no expressions denoting left and right, because the left-right-axis is not explicitly determined in this culture. It is on the contrary almost impossible to neglect the importance of the vertical axis by providing no language means to refer to it.

After having shown some of the most important perceptual presuppositions for the representation of spatial phenomena I will now proceed to some questions of representation.

2.2 reference frameworks for representation of object locations

As has been said, the body axes make up a coordinate system that serves as a reference framework in which locations of objects can be determined along the dimensions head-feet, front-back and left-right. Because the origin of this coordinate system is the observers body I call this framework the egocentric frame.

As experiments revealed we have besides the egocentric frame to distinguish at least one more (for which there seems to be neurological and psychological evidence). This is the allocentric frame which is constituted by an orthogonal coordinate system that does not have its origin in the observer but rather in another object serving so as referential landmark for the determination of locations of other objects. So in this framework we take an object other than the human body of the observer as the landmark to represent and–using language to describe the position of another object. I adopt here the hypothesis of even one more referential framework (Bryant, 1992) calling it the projected egocentric frame which is based on the body but projected mentally into a space different from the real one and serving as egocentric frame there. Since it is not based on direct observation of the real world it is a phenomenon which is created in a mental space. This notion will help to explain the phenomenon of deictic shift later. for neurological evidences for egocentric and allocentric frames see e.g. (Gallistel 1990 p.106-110).

These frameworks provide the basis for a mental space representation model. We can change between the referential frameworks according to our task requirements depending for example on whether we are interested in the space surrounding the body (egocentric frame) or whether we are interested in spatial relations of objects other than the human body (allocentric frame) or if we are conjecturing about being in a fictive environment (projected egocentric frame). We can transfer information encoded within one framework into another by relatively simple translation operations (Gallistel 1990 p.106). It is interesting to note that findings show differential accessability of objects in spatial representations. (Hintzman

et al., 1981). We find here that important factors as salience of spatial dimension and the possibility to interact with objects according to their position and relations play a major role in how quick we can perform cognitive operations with them. So the front of the body and the space it faces is more salient than the back because we can readily interact with objects in front of us but not in the same way with those in the back (Bryant et al. 1992). An interesting question in respect to the distinction of referential frameworks is how we store spatial information, in an egocentric frame or rather in an allocentric frame? First of all we have to distinguish here between storage in the working memory and storage in the long term memory. In the case of working memory storage we store information dependent on a current situation and can erase it later. The contents of the long term memory are intended to be applicable basically to many situations, they must be universally applicable and easy to manipulate. I conjecture that we store information in the long term memory in an allocentric framework. This hypothesis is based on the fact that in most cases allocentric relations are more stable than egocentric because we move around and observe relations from many perspectives, so that the question would be which perspective has to be stored in the long term memory? It is also an interesting and arguable question whether the coordinate system that is made up by such a referential framework encodes locations in a relative or rather in an absolute manner i.e. are locations encoded in respect to the position of other objects or are they encoded using a kind of absolute coordinates. I would argue that locations are encoded in an absolute coordinate system, because we can not only determine and cognitively represent object locations but also empty spots. Thus we can represent by adopting this view information in a more qualitative and precise kind rather than in a totally relativistic encoding. Neurological evidence for this claim comes from findings by O.Keefe and Nadel, 1987 who found evidence for absolute allocentric place encoding in the mammalian hippocampal area and respective findings by Farah et al 1990 for egocentric encoding using an absolute coordinate system. Emerging from the representation in a framework as described above is a cognitive map as mental model of a spatial scene providing the necessary coordinate information for its construction. Kesner et al., 1989 report the organization of egocentric cognitive maps in mammalian frontal cortex. Also Tamura et al., 1990 give evidence for hippocampal structures in mammals responding to locations in the allocentric space.

To sum up, the coordinate systems used to determine spatial positions of objects are the bases for mental models of space i.e. for memory representations of environments. Salience is also represented in form of accessibility preference within certain subspaces.

The important point to make here is that the choice of a certain reference framework may be a precondition to how we encode spatial information into natural language utterances. Before I deal with questions of more direct linguistic concern, one more very important question in connection with referential frameworks has to be asked: What are the criteria according to which an object is chosen to serve as a center of an allocentric coordinate system? In other words, which object is serving as landmark for the determination of the position of another object? This is a question referring to the distribution of attention over portions of an observed spatial scene into focal and backgrounded portions. I will briefly say something about this issue.

subsectionDistributed attention and imputations of spatial scenes

In observing scenes we distribute our attention unequally over the portions of the scene.

Our strategy to locate a certain portion spatially i.e. to determine its position in the scene we pick out a reference object which serves as a landmark relative to which we determine the position of the portion in question. Thus we must distinguish two kinds of scene portions we pay attention to when determining spatial positions:

- a reference portion serving as landmark and thereby as the center of the coordinate system of the referential framework we apply. If we apply the egocentric or the projected egocentric framework, this landmark is our body. Otherwise we apply the allocentric framework.

- the portion whose position is to be determined according to the landmark. I call this portion the trajector. (Langacker, 1987)

if we specify trajector and landmark, we make a figure-ground distinction where the figure is the focal element, that one that is spatially related to the ground object the position of which is known already and which I call the landmark. The overall gestalt in which this figure-ground-distinction is made is of course the whole scene.

We find this process analog in language utterances. Every expression singles out a particular substructure as a focal point relating it to the contextually bound portion (Talmy, 1983). There exist certain preference rules that determine which portion may serve as landmark in respect to the location of a trajector. The question here is given a scene, which criteria or rules are there to prefer one object to serve as landmark over another? I call these preference rules imputations of spatial relations. It might be useful to give some examples of these rules since it is hardly written about them in psychology as well as in linguistics and they play a role in the cognition of space but also are analogously used in producing language utterances talking about space, because the substructure referring to the trajector plays the focal point in the utterance. In the following I give some examples. Consider:

1.a) The truck stands near the garage. trajector = garage, landmark = truck

1.b) The garage stands near the truck. trajector = garage, landmark = truck

One could have expected these sentences to be synonymous on the grounds that they simply represent the two inverse forms of a symmetric spatial relation. But the obvious fact is that they do not have the same meaning. They would be synonymous if they specified only this symmetric relation–i.e., here, the quantity of distance between two objects. But in addition to this, 1.a) makes the nonsymmetric specification that the garage is to be used as a fixed reference point by which to characterize the trucks location, itself to be treated as a variable. This nonsymmetric role assignments conform to the exigencies of the familiar world, where infact garages have locations more permanent than trucks so that 1.a) reads like a fully acceptable sentence. The sentence in 1.b), on the other hand, sounds quite odd, and is thereby well flagged as semantically distinct from 1.a). Since the assertion of nearness is unchanged, the reason for the difference can only be that 1.b) makes all the reverse reference assignments, ones that in its case do not happen to match our representation from the familiar world (Talmy, 1983). we tend - in choosing trajector and landmark to obey - the imputation:

prefer the fixer portion of a scene as the landmark!

now we have to ask:

- How to choose if both objects are movable?

- How to choose if both objects are fix?

To answer these questions let me therefore consider the following examples:

2.a) The car stands near the truck.

2.b) The truck stands near the car.

3.a) The bush stands near the house.

3.b) The house stands near the bush.

it can easily be seen that the b-sentences are in 2. and 3. the odd ones. The reason is straight forward the following imputation:

If two objects are to be related to one another the smaller should be determined as the trajector!

An interesting question is, given the imputations that more movable objects are related to more fix and that smaller are related to bigger, whether they have a certain degree in power, i.e. is it the case that one of these imputations can have dominance over the other? We can test this in that we look at sentences describing scenes of either a small movable and a big movable object or a big movable to a small fix object, which are inverse cases of those considered above:

4.a) The truck stands beside the bicycle.

4.b) The bicycle stands besides the truck.

As expected, the imputation that the bigger is the landmark seems to work.

5.a) The crane stands near the bush.

5.b) The bush stands near the crane.

the sentences in 5. sound rather artificial. this may be taken as a kind of hint that we do not relate bigger movables to smaller fixes, neither as trajector nor as landmark rather we look always to something that is both, bigger and fixer to be the landmark.

I would like to point to some further imputation in respect to the just described. Consider therefore the sentences:

6.a) The cat sits near the house.

6.b) the cat sits (in front of The door) (at the corner) (on the stairs) of the house.

6.c) The cat sits on a tree near the house.

we can see that 6.a) is not very powerful in expressing the position of the cat. The reason is that the relation of size of the two objects which are related to each other is unproportional. in 6.b)In contrary we relate the trajector (cat) to a landmark (part of the house) that is in size more appropriate to the size of the cat, allowing so a more adequate description of the trajectors position. While we relate the position of the cat (the trajector) to a part of the (unproportionally sized) landmark we relate the trajector indirectly to the landmark in that we first relate it to an landmark that is both, more appropriate to be the landmark for the trajector cat and more appropriate to be a trajector to the landmark house. from this we can conclude the following imputation:

Related objects are chosen to be compatible in size!

It seems to be the case that we can find in the example 6. still another hint to an imputation. It is often the tendency that a landmark has a more complex structure than the trajector. (that it consists of more obvious parts). This may partially be the case because the landmark tends to be bigger than the trajector, partially it may be due to the fact that the landmarks structure is chosen to relate the trajector appropriately, e.g. to

relate it to some structural portion (corner, door, trunk) and thus a more concrete position description of the trajector can be achieved.

These examples of imputations should have made clear that we do not randomly relate objects in a scene to each other but make decisions guided (but not forced) by imputations of the kind just discussed. These imputations are rules for conceptualization and distribution of attention which are well observed in language utterances. This might be even the reason to treat imputations as semantic rules, but since they are not restricted to language I treat them as cognitive rules with direct impact on language utterance production and understanding.

2.3 Basic cognitively induced components of deictic relations

We have seen that basically two different referential frameworks are used to determine spatial relations (the projected egocentric framework is considered as not genuinely a frame on its own, rather it is an egocentric frame applied to a spatial constellation present in mental space). In fact both of these frameworks are involved in the cognitive representation of a deictic spatial relation. A deictic spatial relation is sensitive to two spatial constellations:

- the relation between a landmark and a trajector making up a scene s_a
- the spatial relation between s_a and the observer of this spatial constellation o

To illustrate this consider the following example:

7. The cat plays in front of the tree.

This sentence is deictic because we have to know the position from where the spatial relation between the cat and the tree was observed in order to know exactly the location of the cat. The reason for this is that a tree does not have an intrinsic orientation so that we cannot determine a front-back-axis or a left-right-axis according to its geometric features or other criteria which would be necessary to have to determine something to be in front. In other words, the landmark in the scene s_a which is the tree cannot provide an unambiguous allocentric coordinate system for the location of the trajector of s_a which is the cat, because it does not have an intrinsic orientation that could serve to distinguish clearly a front-back-axis. Thus in order to interpret this sentence appropriately we have to use knowledge about the situation in which this sentence is produced i.e. we have to use our knowledge about the speakers position which was not expressed in the sentence. So the interpretation of this sentence is dependent on the physical setting of the situation in which it is produced. According to my introductory characterization of deixis this sentence is deictic.

We have two spatial relations in this sentence:

- a spatial relation between the cat and the tree (as the scene s_a where the index a says that the landmark constitutes the origin of an allocentric referential framework for the determination of the position of the allocentric trajector, here Accordingly, the allocentric landmark (tree) will be referred to as $landmark_a$, the allocentric trajector (the cat) as $trajector_a$.
- the spatial relation between s_a i.e. between the spatial relation between cat and tree as scene s_a and the point of the observation o. This scene is referred to as S_e

where the e denotes that the landmark of this scene is constituted by the observers body being the origin of an egocentric coordinate system serving to locate s_a within the egocentric reference frame. Accordingly, the egocentric landmark (observer) is referred to as $landmark_e$ and the egocentric trajector (the scene S_a) as $trajector_e$.

Note that if the point O is changed the relation in S_a may not be denoted by the spatial expression *in front* anymore as will be illustrated further below.

When we recall the definition of deixis above we see that the scene in s_a is interpreted in the frame provided by the spatial constellation in S_e. So we have a two-level-hierarchy of scenes here:

1. $s_a \rightarrow landmark_a$ and $trajector_a$

2. $s_e \rightarrow landmark_e$ and $trajector_e$

According to what I have said about the frameworks we can see that s_a is represented in an allocentric frame while s_e is represented within an egocentric frame. The egocentric frame provides the representation of the physical setting for the interpretation of the spatial relation in s_a which must be known to interpret the allocentric scene correctly. Furthermore, the egocentric coordinate system is projected onto the allocentric landmark to give it a (setting-dependent) front-back-axis so that we can speak of something (the cat) being in front of the tree.

In this characterization of a spatial deictic relation we can distinguish the following components:

- an allocentric landmark
- an allocentric trajector
- an egocentric landmark (typically the observers body)
- an egocentric trajector (the scene represented in the allocentric frame s_a)

To use a less confusing and more appropriate terminology I will call the egocentric landmark being the vantage point for the interpretation of the spatial relation in s_a the *deictic center*. Further I will speak of the scene s_a as the *deictic object*. Finally, I call the space including the deictic center and the deictic object the *deictic space*.

What does it now mean that the deictic object is interpreted within the deictic space in respect to the deictic center? Such an interpretation has two important phenomena to consider:

- the deictic objects location is evaluated in the egocentric framework of the deictic center
- The landmark of the deictic object may get imposed a coordinate system in respect to the deictic center that serves to evaluate the position of the trajector in the deictic object

So the position of the deictic center in respect to the deictic object has not only effect on the interpretation of the relation between deictic center and deictic object but also on the interpretation between the landmark of the deictic object and the trajector of the deictic object.

I now will come to the discussion how those phenomena just outlined are communicated by means of a natural language.

3 Linguistic aspects of spatial deixis

Let me now include linguistic questions into this discussion. After we built a cognitive representation of a spatial scene we are potentially able to communicate about it, provided we have some language at hand to encode our cognitive representations.

3.1 Spatial language

Language explicitly expresses spatial information and offers insight into the internal conceptual representation of space. The physical constraints of space are intimately woven into the fabric of most languages (Miller & Johnson-Laird, 1976), and several theorists (e.g. Clark, 1973; Levelt, 1984) have argued that the way people perceive space determines the way they linguistically represent it. Consequently, the form that spatial language takes is shaped and constrained by the perceptual representations used to deal with the environment.

The most basic feature of space represented in language is its three-dimensionality. All languages employ terms for the three dimensions of space.

Relations in space are defined with respect to objects, planes (such as the ground), or some point of reference serving as a landmark for the location of something being the trajector. In locative expressions, one or more reference objects are used to locate another object (Clark, 1973; Levelt, 1984; Talmy, 1983). Spatial terms either make explicit spatial properties of an object (e.g., top or bottom), or the relation between objects along a dimension (e.g., above or below) to specify spatial relations (Olson & Bailystok, 1983). Spatial terms also require the notion of direction, which is necessary in order to specify location perceptually. For example, high and low refer to particular directions along the vertical dimension.

A linguistic schema, specifying the landmark, trajector, and relationship between objects, is used to interpret spatial expressions (Talmy, 1983, Lakoff, 1987, Langacker, 1987). Another perceptual bias is the preference shown for selecting as a reference point the most salient and stable objects, points, or planes in the environment using thereby imputations of the kind given above. Spatial descriptions require a perspective or point of view from which spatial relations can be specified. This is a result of ourselves occupying, at any moment, a particular location in space from which we experience the world, and the fact that relations have to be specified with reference to some object or point. Two frequently used perspectives are the deictic and intrinsic systems (Levelt, 1984).

In the deictic system, spatial terms are interpreted relative to one's own position, with respect to one's body sides, the front, back, sides, etc, as was shown already in 7. Distance terms such as near and far are interpreted with respect to oneself also. In the intrinsic system, spatial terms are interpreted relative to the position and body sides of another

person or object that has a definite front, back, and sides. (Levelt, 1984) argues that the deictic system is the default way of referring to space because it can always be used, even when objects lack intrinsic sides, or are in atypical orientations. The deictic system also represents space as it is perceptually structured, indicating distances with respect to our own position in space, and directions with respect to our body sides.

Thus these are the means a language must provide to talk about space:

- names for distinct portions in scenes referring to the objects representing these portions e.g. circle, square but also complex objects as dog, house etc
- names for shapes to determine portions e.g. elliptic, cubic, round
- language items that denote spatial relations between scene portions as prepositions like on, beside, in
- items denoting certain extensions and directedness within a certain spatial dimension as in front of, left of, below

For more details see (Bennett, 1975) and (Jackendoff & Landau, 1991).

I will gradually examine and extend those spatial expressions that have crucial deictic meaning.

3.2 Deixis as referential phenomenon

We can distinguish in communication between referential acts and predicational acts. Referential acts inform about which object(s) we are talking, or, for non-verbal communication, to which object(s) we pay attention, while predicational acts say something about the object(s) - its properties - we are communicating (Schmaugs, 1991 pp. 34). See the examples:

referential:

8.a) It is this tree.

8.b) I will buy the car in this shop.

8.c)! Look at the white house

predicational 9.a) Mary wears a red dress.

9.b) California is a beautiful country.

9.c) The apple tastes good.

In the problem of deixis we are faced with the question of reference identification: the receiver of a deictic utterance has to find out about which object an utterance containing a deictic expression is talking. I said earlier that in order to represent spatial entities we use at least two referential frameworks. In the task of the interpretation of deictic utterances i.e. the cognitive reconstruction of a scene that is described by the sender by means of a deictic utterance, we have to instantiate the trajector in an allocentric referential framework in dependence on the position of the human body as center of the egocentric referential framework from which the evaluation of the allocentric framework was made.

I now will look a little closer at the components of the world that play a role in the construction and interpretation of deictic utterances and will show that

these influencing phenomena are far more than those outlined in the section above.

3.3 Meaning Components of language expressions denoting deictic relations

When we research the phenomenon of spatial deixis we have to find out which relevant components of this phenomenon can be/have to be distinguished. As touched on briefly, we have to distinguish two different relations:

- a spatial relation between a landmark and a trajector in a scene
- a spatial relation between the spatial configuration in this scene and the deictic center

The critical point is that we have to interpret the spatial relation in the scene with respect to the spatial relation between the scene and the deictic center.. First consider some examples of utterances denoting spatial deixis

10. The knife is lying right of the plate. The landmark of the deictic space is the speaker. The landmark of the scene described in this sentence is the plate, determining the center of the allocentric coordinate system. The knife, being the trajector is related to the landmark. The space covering landmark and trajector (plate and knife) constitutes the deictic object. The deictic object is related to the spatial position of the speaker uttering the above sentence. The effect of this relation is the speaker-position-dependent naming of the axes of the allocentric coordinate system. Note that it is not critical whether the deictic object itself is in the egocentric system to the left or to the right of the deictic center.

There are two a case of deixis i want to mention because it is a kind of reduced deixis where we do not have a deictic object consisting of a landmark and a trajector, rather we have only a trajector that is directly related to the position of the human body as being the landmark as well as the deictic center at the same time. (thats why I speak of a deictic object rather than of a scene):

11. The village is to the left.

In the other case we insert as the landmark the earth as in:

12. The kite is up.

I will come back to these cases when we speak about deictic defaults. After the notion of spatial deixis has been exemplified I proceed with a consideration of which grammatical categories can serve to express spatial deixis since it is a valid question to ask whether a language uses certain grammatical categories to refer to deictic phenomena or not.

Deixis does not have the restriction that only a certain grammatical category could express it. Rather, there is a broad variety of categories in which we can find deictic elements. Here is a brief summary and exemplification:

demonstratives:

13.a) Which do you like best: *this* one or *that* one?

13.b) *These* hills are quite close to the sea.
13.c) *Those* people do not like Chinese cooking.
adverbs
14.a) I am staying *here* for a year.
14.b) Last time I was *there* it was pretty cold.
prepositions
15.a) The cat is playing *behind* the tree.
15.b)
Our house is *right* of the lake.
adjectives
16.a) The restaurant is on the *right* side of the street.
16.b) In the *left* corner stands a lamp.
verbs
17.a) They *come* frequently to our garden.
17.b) We *go* sometimes to the movies.
affixes
18. in Indonesian, the suffix *nya* means *this* as in: *Orangnya* ada dari Amerika. This man is from America.

3.4 Deictic defaults

As I have hinted at when describing the basic components of deictic relations we can, among all the objects of which we can specify their spatial position and relations to other objects, distinguish two of particular importance in human cognition. The first is the body of the speaker of an utterance since it determines the coordinate system used to structure the egocentric space by constituting its origin. It constitutes defaultly the deictic center i.e. the landmark of the egocentric frame and is mostly not mentioned explicitly in a linguistic utterance but must be instantiated by the receiver of the utterance.

19.a) The ball lies left of the pole.

Defaultly, the deictic centers location is assumed at the place where the speaker is standing.

The second particular object is the surface of the earth. It defaultly can play the role of the landmark of the allocentric frame. This is for two major reasons:

1. the surface of the earth is ubiquous
2. because of the phenomenon of gravitation for which we have a particular organ to perceive

Thus while the location speakers body constitutes the deictic center as default case i.e. when no deictic shift was explicitly or implicitly announced, the earth constitutes the landmark of the deictic object.

19.b) We moved along slowly.

If no special information was given it is assumed that the motion took place on the surface of the earth. However, it may often happen that the human

body serves both functions, the deictic center as well as the landmark of the scene. It is then a question of world knowledge to detect whether the earth is the landmark of the scene or the human body. Consider:

19.c) The library is to the left.

Here the deictic center is the speaker who plays at the same time the role of the landmark of the deictic object. The surface of the earth cannot be landmark of the scene because we cannot place something left of the surface of the earth. To determine which object (human body or earth surface) has to be instantiated as landmark of the scene is a matter of possibility or probability and depends on the knowledge about the world and possibly the anticipation of goals of the speaker what he/she wants to communicate and which dimensions are involved in determining the location of a trajector in the deictic object.

3.5 Intrinsic and deictic uses of natural language expressions

There is a number of natural language expressions that can, according to the context, have an intrinsic or a deictic i.e. indexical function and are so polysemious. In particular prepositions are of this kind. The criterion for an intrinsic vs. a deictic use of a language expression is whether the allocentric landmark has an intrinsic orientation and can thereby provide an unambiguous coordinate system for the description of the allocentric trajector or not. If the allocentric landmark can not be assigned an unambiguous coordinate system it gets assigned a coordinate system which is dependent on the position of the deictic center, therefore the position of the deictic center has to be taken in account into the interpretation of such a deictically used language expression. We can use prepositions in their non-deictical i.e. intrinsic meaning in the sentences:

20.a) The car is parked in front of the building.

20.b) The clerk stands behind the counter.

The meaning of these sentences is not dependent on special features that have to be delivered by the context of the utterance because the allocentric landmarks have distinguishable dimensional/directional features. We know that a house has a front and a counter has a backside (and thus the house having a backside and the counter having a front). Since we have all information about the objects to determine their front and back these sentences are not deictic. front-back is determined by certain inherit asymmetries of the allocentric landmark (front is determined according to moving direction, a canonical means of human access to the object or to the objects similarities with the human body) Thus when we utter a sentence of 20. the position of our body for the assignment of axes names for the allocentric coordinate system is not necessary.

However, there are cases where we use the words *in front of* and *behind* with objects that do not have an obvious front and backside but get it as an attribute critical to the spatial position of the deictic center. Examples for this case are:

21.a) He is standing in front of the door.

21.b) The child hid behind the tree.

As can be easily seen *in front of* and *behind* is in these cases relative to the position of the deictic center because doors and trees do not have an intrinsic front-back-side. Rather, front and backside is assigned to them by the speaker. This means that the landmark of the allocentric coordinate system is assigned a coordinate system by the speaker that is sensitive to the position and direction of observation of the speaker. Another even more illustrative example for this assignment of a coordinate system is the following: Imagin the speaker stands facing a tree. Between him/her and the tree might sit a cat. He/she could say:

22.a) The cat is sitting in front of the tree.

Moving to the side of the tree clockwise and turning to 90 degrees it can be truthfully uttered:

22.b) The cat sits right of the tree.

Repeating this procedure once more it could be said:

22.c) The cat sits behind the tree.

and, after another repetition of this procedure:

22.d) The cat sits behind the tree.

It is interesting to note that the assignment of what is front and what is backside may differ with cultural areas. We can distinguish an ego-aligned vs. an ego-opposed way of front-back-assignment. In the ego-aligned way (e.g. in the hausa community as described by Hill, 1975) the side that faces the deictic center is assigned the backside - in the ego-opposed way in most cultures the facing side is assigned to be the front side.

Dealing with trees, poles and things having no marked orientation is rather simple to describe in deictic relations, since we can assign a front side at each side. It is more difficult if we have objects that have an orientation but no direction. Consider such objects like cigars: we have two long and two short sides i.e. there is an elongated orienting axis but we can not say what the front side is. If we assign the front side, we can only do this to one of the short sides but (at least I think so) not very likely to a long side.

Another case with face assignment is the following: a car normally has some front side that is determined by its typical direction of movement in analogy to the human body. Functionally, a car has some resemblance to a house in that it has a side (infact two, but this is not the point here) that has a door. From this functional point we could assign a front side to a side with a door, thus we can interpret the following example in two ways:

23.a) The dog is standing in front of the car.

as:

23.b) The dog is standing so as to block the direction of movement of the car. or

23.c) The dog stands so as to jump into the car.

There is a further distinction to be made in assigning front and backside to a non-intrinsic object: this regards the fact whether the speaker is observing from outside the object in question or whether he/she is inside. For example, a person standing in a silo that has a cube-like form, this person would say:

24.a) The truck stands in front of the silo.

if the truck stands outside of the silo closest to the wall that is faced by the speaker. This speaker would say:

24.b) the truck is in the back of the silo.

when it stands closest to the wall opposite the wall that is faced.

If the speaker does not stand inside the silo he would say *in front of* when the truck stood closest to the side facing the speaker and he would say *behind* when the truck stood closest to the opposite side.

To summarize what I have said about intrinsic vs. deictic uses of natural language expressions: The criterion whether we use a (deictically usable) language expression in its intrinsic or in its deictic sense is dependent on the question whether the landmark in the deictic object has its own spatial orientation and can thereby assign directions to the axes of the allocentric coordinate system (like left, in front of) or if this naming of the axes has to be done from the in dependence of the spatial orientation of the body of the observer.

3.6 Preciseness of deictic expressions

If we want to get a grip on how to classify deictic expressions (or those expressions that can be used as deictic expressions) we can distinguish them according to whether and in how far they give us information about the spatial dimension or even direction of a spatial relation the denote. Consider the following examples:

25.a) The child stands left of the pole.

25.b) The child stands besides the pole.

25.c) The child stand there (pointing into the direction of the pole).

While example 25.a) is precise in dimension (and direction left-right-axis of the human body is projected onto the allocentric coordinate system and the direction on this axis is specified by the preposition *left*), *besides* in example 25.b) is precise in dimension (left-right-axis) but not in direction (unclear whether to the left or right direction). In 25.c) neither the dimension nor the direction is given by the meaning of the deictic expression *there*. Note that we have in English an expression that gives unprecise information on which side something is located in the horizontal coordinate (left-right) but we do not have an expression of that kind for the front-back-axis nor for the head-feet-axis. Note also that dimension information and direction information is not the only one that determines the preciseness. In a language such as Diurbo, spoken by Australian aborigines, or some languages of native Americans there are expressions that give also information about the kind of space like: downhill or upstream.

Whether an expression that is more precise or one that is less precise will be used is a matter of context and intention.

3.7 Gestural vs. symbolic deixis

There are two ways in which we can transfer information: by means of natural language and by non-verbal means such as pointing, mimics and other actions

where movement is involved. This fact can be used to distinguish spatial expressions according to whether they can be interpreted without supplementary non-verbal means being performed parallel to the production of an utterance or if such a non-verbal gestural action is necessary. According to these two ways of communication we can distinguish two subtypes of spatial deixis:

- symbolic deixis where no non-verbal action is necessary for the interpretation of an utterance
- gestural deixis where gestural action is necessary for the interpretation

We have seen that we can specify the dimension and direction of the deictic object seen from the deictic center by help of linguistic means as by use of prepositions *besides* specifying the dimension left-right-axis or, more precisely as with *left of, right of, in front of, behind* that specify as well dimension (left-right and front-back axis, respectively) as well as the direction on these axes. Because we give the dimension and direction information by using a linguistic symbol we call this kind of deixis the symbolic deixis. We could make here even a further distinction into symbolic deixis giving directional information (*left, in front of* ...) and that giving only dimensional information (*besides*). On the other hand we saw that words like adverbs *here*and *there*do not give dimensional and directional information. But we can give additional information to determine dimension and direction by using extralinguistic - gestural means e.g. pointing with the index finger, looking in the relevant direction etc. We speak of this kind of deixis being supported by gestural means as gestural deixis. To put it in other words: the difference between symbolic deixis and gestural deixis is the way in which we reduce the physically three-dimensional space we can talk about to a quasi one-dimensional space (the dimension axis being communicationallly relevant) and even further down to a certain direction in this one-dimensional space.

I should also mention a third kind of deixis here, which is, however, in this frame less important, the anaphoric use. In the anaphoric use it is referred to a place that has been mentioned in the discourse before therefore no non-verbal means are necessary. Here are examples for each kind:

symbolic

26.a) The car stands left of the house.

26.b) The village is ahead of us.

gestural:

27.a) Go there and sit down.

27.b) Where do you want to sit: here or there?

anaphoric:

28.a) I went to Paris and spent three weeks there.

28.b) Last week I went to Yosemite and spent three days in this area.

It is needless to say that a necessary condition for the use of gestural deictic utterances is that the addressee has visual access to the speaker and thereby to his gestures.

3.8 Proximal and distal categorization

In all languages I am aware of a difference is made into proximal and distal categories, denoting distance/proximity between the deictic center and the deictic object. Compare the following examples:

29.a) Sit here.

29b) Look there.

29c) The shop is on this side of the road.

29d) You should rather buy this book than that.

The distinction of proximity and distance is a very important and obvious Categorization of spatial deictic expressions. It refers to the relation (proximity/distance but infact mainly to other phenomena) between the deictic center and the deictic object.

The problem is to find out the criteria which are applied to choose a certain deictic expression regarding its denotation of proximity/distance. Related questions to ask are:

- How many deictic expressions denoting proximity/distance are there and what are there ranges in a language?
- Are there other criteria than proximity/distance that influence the choice of such a deictic expression?

In the simplest case (as we see it actually in English) we have just one deictic expression denoting proximity and one denoting distance. In English these deictic expressions are *here* (proximal) and *there* (distal). To these deictic expressions are often demonstratives having the proximal/distal feature related, in English these are *this/these* and *that/those*. Consider the examples:

30.a) Here I will rest for a while.

30b) It is always nice whether here.

30c) This house is many years old, much older than that (over there).

30d) That street leads to the town.

What do we having a proximal and a distal category is to divide the three-dimensional space up into a proximal portion and a distal portion? In cases where gestures can be used to support verbal communication, the distinction between proximal and distal use may be not critical as in 30.a) and 30.b) where here and there, standing for two different places, can be distinguished by pointing.

First let me show that the extention of space is not critical to switch the proximal/distal deictic expression. In all cases in 31. the deictic expression *here* is appropriate although the there is a big difference in the spatial distance that is denoted in the examples:

31.a) Here I sit and watch the life there in the street (on a chair near the window).

31.b) Here it is mostly nice weather (in a region of a country).

31.c) From here this star is 12 billion light years away (from our galaxy).

Obviously, the size of space does not have an influence on the choice of the deictic expression in 31.a) to 31.c). A conclusion of this fact is, that one that the actual size of the proximal space is not critical for the choice of the proximal deictic expression *here* despite of the consequence that the deictic object may be in very big distance from the deictic center. The space of attention, that is made the proximal space by putting the focus on it id is mostly defined indirectly as to where its borders are. By indirect I mean that it is only said what does not belong to it. For example in 31.a) we are not told where *here* ends and *there* begins i.e. where the border between proximal and distal space is, rather we are told explicitly that the space containing the street is outside of the proximal space. In 31.b) we have no border characterization at all. To find out something about the borders of the place where it is mostly nice weather we have to infer from our world knowledge what possible weather zone determining factors are and thus how big this area denoted by *here* could be. Just to give an illustration, the following inference process could be invoked by 31.b) to find out how big the space denoted by *here* may be:

- Where is the speaker situated at the time? (Berkeley California).
- What are commonly weather influencing factors? (sea, hills...)
- Where is the next sea, are the next hills? (inferencing from the knowledge or a map)
- At least one could say the region between the bay and the hills belongs to the region referred to as *here* by the speaker.

To show how diverse knowledge can be to infer the size of proximal space, in 31.c) we could infer the size of the proximal space from the precision of the number and the size of measure. Since the number can be taken to be rounded (because it is rather unlikely that the distance is so precise a number one would round to and no gradator such as exactly is given) and the metrum is very unsharp the inference to include the whole galaxy into the proximal space is possible.

Now consider the following example:

32.a) Here we have the bacterion causing the disease. (in a drop of fluid under the microscope)

32.b) Please give me the book standing there on the shelf!

32.c) It takes us 5 minutes to go there.

What are the criteria here to use *here* in 32.a), but *there* in 32.b) and 32.c)?

I want to argue that the distinction into proximal and distal space is also dependent on the possibility of interaction with the location of the deictic object in the spatial configuration in which the according utterance is produced. To see what I mean compare 32.a) on the one hand with 32.b) and 32.c) on the other. Why is *here* appropriate in a) but not in b) and c)? The reason is that the speaker, sitting at the microscope can readily interact with the drop of fluid since it is in direct reach of his/her hands, but he/she neither can

readily interact with the book on the shelf nor with the place where it would take him/her 5 minutes to go. This phenomenon of interactability seems to go under the notion of force dynamics (Talmy, 1987, 1988). Given a structured scene, this notion involves the forces that the elements of the scene exert on each other. Comprehended here are the notions of force exerted by one quantity on another, as well as notions of resistance to such force, the overcoming of such resistance, blockage to the exertion of force, and the removal of such blockage. In particular, the following are the key components of a force dynamics schema:

In the scene a distinction is marked between the two entities exerting the forces. One force-exerting entity is singled out becoming the more salient entity in the interaction. The issue here is whether this entity succeeds in manifesting its force tendency or does not i.e. is overcome. The other force entity is considered for the effect it has on the first, effectively overcoming it or not. (Talmy, 1988) calls the focal entity the agonist, the other entity the antagonist.

An entity is taken to exert a force by virtue of having an intrinsic tendency towards manifesting it. This tendency may be either towards action or towards rest.

A further concept is the relative strength of the forces manifested by the opposing entities, the entity that succeeds to manifest its tendency at the expense of its opponent is the stronger. According to their relative strengths, the opposing force entities yield a resultant, which is assessed for the agonist as the focal entity and whose circumstance is at issue.

Applying this idea to our case here the scene is the deictic space with the components deictic center as the agonist and deictic object as antagonist. The question in our interactability case is: how much force–or energy does the agonist (deictic center) need to become able to interact with the antagonist (the deictic object). If the deictic center is itself the landmark of the deictic object, then the expense is practically none and we can use the proximal deictic expression. If, on the other hand, the expense of energy that has to be spent for interactability is rather high, then the distal deictic expression is used. How high must the expense of energy be to switch from proximal to distal use of the deictic expression? I take the following factors to be most influencial on the considerations to make a distinction between proximal and distal use:

- amount of energy that the deictic center is able to invest to interact with the deictic object
- How much energy is necessary to interact with the deictic object

But the answers to these questions are due to subjective judgement and may so differ from individual to individual at least within certain ranges.

Yet another influence besides the usage of proximal/distal deictic expressions to encode the degree of interactability is to use them for relative degree of interactability in the following sense: Imagin two objects are quite accessable, the one a little better than the other. Although the one being farther away could be treated as a here–or this case, it is treated as a there/that case to

distinguish it from the other that is relatively better accessable although both may be typical cases for proximal deictic expressions in another context.

33. On the table before me sand two cups. This is red, that is blue.

But force dynamics applied to physical accessability is not the whole story here. We find for example the demonstrative *that* denoting the distal category applied to talk about objects that are–from a physical point of view–clear thiscases. The reason for these uses is, that proximal/distal deictic expressions are not limited to physical triggers, rather they are also used to denote psychological/emotional proximity/distance. to denote emotional proximity/distance the spatial domain is mapped metaphorically into the domain of emotional space. Consider 34.:

34.a) I love these big trees in the Sierra Nevada.

34.b) I hate that book I am just holding in my hand.

I agree with (Talmy, 1988) that this is also a case of force dynamics, mapped from the physical and presumably original domain into the psychological/emotional domain. Agonist and antagonist are the same here, the deictic center and the deictic object, but the forces that are crucial are not physical, rather they are those of emotional proximity/distance. Note that in 34.b) the deictic center is at the same time the landmark of the deictic object, so physical interactability is optimal, but because of emotional distance *that* is used rather than *this*.

The last example makes clear, that entities in certain domains, here in the domain of space and spatial interaction, are often influenced by factors in other domains or are used to denote phenomena in other than their original domains (see Lakoff, 1987) for a broad discussion. The domain of space is in this respect source domain for many other domains, infact, it seems to be one of the most basic domains we have that is the source for metaphors for other more abstract domains. Since the spatial domain plays such a basic role in cognition, there maybe more (and surely is) to the explanation of proximal/distal distinction. But I will now turn to some considerations on multiple distinctions of proximity/distance.

3.9 Multiple categorization of distance

In many languages we find more than two categories of proximity-distance, however, every language seems to have at least the one distinction into a proximal and a distal category. English, as we saw, is a language of that kind (the old form yon and yonder which could be considered as a further distinction are to my knowledge no longer used). A language having a further distinction is Japanese with the forms *kore*, *sore*and *are*, and German with the forms *hier*, *da* *and* dort.

There are even cases where we have a distinction into four different categories as in the language Tlingit, where we have forms expressing the meanings of something like *right here*, *right there*, *over there*, and *way the heck over there* (Fillmore, 1972). A critical point with proximal and distal categories is that they may be sensitive to not only the place of the speaker as deictic center but also to the place of the addressee or even to the place of

some audience. (Fillmore, 1972, p.43) reports about Samal, spoken in the Philippines, with place deictic terms which separately indicate the position of the speaker, the addressee, the audience, and none of the above. there are separate place deictic expressions for *near me*, *near you*, *near other participants in our conversation*and *away from all of the above*. This would mean that we have to include into the deictic space besides the deictic center (speaker) and the deictic object (scene being referred to by the deictic expression in the utterance) the locations of the addressee and even of a possibly present audience (which could themselves serve as deictic objects).

Another critical point may be the visibility of the deictic object to use the appropriate proximal/distal categories. Thus the moon is in Tlingit in the third (and thus not in the most distal) category, because we can see it, while some animal which is hidden behind a bush ten feet away may be in the fourth category because it is out of sight.

Another influencial criterion may be the question whether the place of a deictic object falls together with the place where the speaker, speaker and addressee or the addressee is at home. We find this phenomenon in some Indian and Bantu languages. These languages have different expressions for *here*as proximal category without the location being the home base of the speaker and *here, where I am at home*.

35.a) Here (where I am at home) it is a pretty rough climate.

The phenomenon of having a proximal deictic expression denoting the home base is called autochtonic proximal deixis which can be distinguished from autochtonic distal deixis. In this case the place of deictic object is the home of at least the speaker, but the place of the utterance is somewhere else.

35.b) There (where I am at home) we have a lot of hills.

In contrast to autochtonic proximal - and distal deixis we have the heterochtonic proximal - and distal deixis: where *here*and *there*do not refer to the home of speaker and/or hearer as in:

36.a) Here (where I am currently standing) it is easy to watch the children.

36.b) There (where a friend of mine lives) it is always nice weather.

It is of course most probable that deictic expressions like these just mentioned in this paragraph have also– perhaps more complex meanings and criteria of choice concerning force dynamics or the influence from other domains such as the emotional space. But little is known so far about these relations and studies would include a lot of difficult field work.

3.10 Deictic shift

A very common phenomenon is the deictic shift. Deictic shift is the transfer of the coordinate system of the deictic center from the speakers place to another place. This is a mental transfer, not taking place in the real world. The point to which the egocentric coordinate system of the speaker (the deictic center) is transferred serves in the utterance as the speakers location. Thus a scene in its real-world-place is referred to from the imaginary speaker location.

I call the coordinate system which is created at the imaginary speaker position, serving as imaginary egocentric system a projected egocentric framework because this coordinate system is built on an imaginary origin as projection point of the deictic center. I mentioned earlier that the projected egocentric reference frame is built up in the mental space of the

speaker where he/she mentally transfers his/her location in such a way that the deictic object can be described successfully using spatial deictic expressions of a language from this mental position. Thereby a mental space is made up by beliefs of the speaker about–usually–the real world locations of objects. Of course, there may be a difference between the constructed mental space and the real world configurations. This mental space consisting of beliefs that describe the real world is often enhanced by hypotheses, which also take the form of beliefs about the world. The important point here in terms of reference frames is that the egocentric frame constituting the coordinate system with the deictic center as its origin is mapped from the position in the real world into another location in mental space. It is thereby not critical in most cases that it is possible to compute the spatial relation between the position in the real world and that in mental space. This is different considering the relation between egocentric and allocentric frame or projected egocentric and allocentric frame respectively where it is critical to be able to compute the spatial relation between real or mental position of the deictic center and the deictic object.

Deictic shift is done by announcing explicitly that the default case for the deictic center in form of the human body of the speaker in the real world no longer holds or it must be inferable by application of default rules. See the example:

37. part of a description of a route:

1. introduction of the area that will become the deictic center: I stood on the hill facing the high Sierra.

2. In front of me I saw the peaks covered with snow.

Deictic shift is, as has been shown, a kind of modelling a situation that is not the real one. It consists of two steps:

1. mental transfer of the speaker to an imagined place that is to serve as origin of the projected egocentric coordinate center structured by imagined body axes.

2. relating deictic objects to this created deictic center.

4 Properties of spatial deictic expressions - summary and implications

What I have done in this paper was to give some perceptual and cognitive foundations to get a more adequate idea of the process how humans perceive and represent spatial entities. My findings of the review of perceptual and cognitive foundations of human spatial abilities should provide a cognitively plausible basis for the development of a descriptive approach to spatial deixis. On this basis I tried to describe phenomena of spatial deixis and the properties making up the components of deictic expressions in a natural language. My ambition was to use not only one language as subject of exploration of its deictic capacities, rather I looked for deictic expressions in a cross-linguistic way.

I postulated two aspects of deixis–the anchoring of a communicational act and the expression of a deictic anchoring by means of a natural language. The following questions characterized this problem:

- How are spatial anchorings for deictic utterances represented and evaluated?
- What lexicogrammatical means does a language have to express those anchorings?

First I explored some perceptual and cognitive abilities for dealing with spatial phenomena to shed light on the first of these questions. I showed that we perceive dimensions/directions of space differently and are differently capable of interaction in them.

We use three axes to structure our surrounding space being the vertical, the observer and the horizontal axis. These axes are different in the way we perceive them as well as in their stability. Thats why they have different importance and influence on our spatial structuring.

mental images of space are built using alternatively three different referential frames for the formation of cognitive maps:

- egocentric system (origin = human body of observer)
- allocentric system (origin = an object as landmark)
- projected egocentric system (origin = a point in space that serves as projection point of the body axes)

Cognitive maps represent spatial configurations shaped by the perceptual apparatus.
I found that deictic phenomena are represented using two spatial referential frameworks:

- the scene constitutingthe the deictic space consists of the egocentric landmark constituting the deictic center and an allocentrib scene as the deictic object
- the deictic object is a scene consisting of an object as the allocentric landmark which has no clearly definable intrinsic orientation and an object whose position is to be determined in respect to this landmark

The deixis space thus consists of a hierarchy of relations:

- between the egocentric landmark forming the deictic center and a (typically) allocentric scene
- the allocentric landmark (that has no intrinsic orientation) and the allocentric trajector

From these findings the following characterization of spatial deixis emerged: Deixis is the phenomenon where the egocentric frame determines the coordinates of the allocentric frame of a reference object in the deictic object.

Then I explored the second postulate concerning the linguistic side of deixis. deictic expressions are referential. deixis can be express by most of grammatical categories. Expressions may have a deictic and a non-deictic meaning depending on whether the allocentric landmark being the reference object for the location of the allocentric trajector has an intrinsic orientation and can thus provide an unambiguous allocentric coordinate system or not. The deictic defaults are the deictic center as the human body of the speaker of a

deictic utteranceand the surface of the earth as the allocentric landmark. The preciseness of deictic expressions differs from three-dimension all-directional to one-directional.We can distinguish gestural and symbolic usage of deictic expressions. We can distinguish proximal up to distal categories. We can refer to imaginary positions of the deictic center.

What means for a classification of deictic expressions do the explorations carried out in this paper provide? I have given a number of semantic components which could be taken as important components of the meaning of deictic expressions and at the same time could serve as classificatory features to distinguish deictic expressions and classes of them. The most important features that could play such a classificatory functions which have been found above are:

- dimension/direction an expression denotes in three-dimensional space
- gestural or symbolic usage of an expression
- proximal/distal denotation

Grammatical classification is in grammatical categories.

What kind of knowledge is necessary for the appropriate usage of deictic expressions? From what has been outlined in this paper the following kinds of knowledge may be relevant for an appropriate usage of deictic expressions:

- knowledge about objects whether they have intrinsic (sufficient) orientation for an assignment of an unambiguous coordinate system or not
- knowledge about spatial positioning between objects in the do.
- knowledge about position of the deictic center to the deictic object.
- knowledge about imputations to pick allocentric center
- knowledge of the amount of visual access of the addressee to the deictic space.
- knowledge about motor accessability and force dynamics.
- knowledge about inferable space boundaries of events.

These findings should provide a basis for the implementation of the ability to use deictic expressions as well as to learn to use deictic expressions. Of course this paper can only be taken as a start for a deeper exploration of the quite numerous topics addressed here. It might serve as a schedule for further research on spatial deixis.

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