

Deixis in human-human and in human-computer interaction

Citation for published version (APA):

Creemers, A. H. M. (1993). *Deixis in human-human and in human-computer interaction: an outline of concepts from the literature*. (IPO rapport; Vol. 891). Instituut voor Perceptie Onderzoek (IPO).

Document status and date:

Published: 02/02/1993

Document Version:

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.tue.nl/taverne

Take down policy

If you believe that this document breaches copyright please contact us at:

openaccess@tue.nl

providing details and we will investigate your claim.

Institute for Perception Research
PO Box 513, 5600 MB Eindhoven

AC/ac 93/05
02.02.1993

Rapport no. 891

Deixis in human-human and
in human-computer interaction:
An outline of concepts
from the literature

A. Cremers

Deixis in human-human and in human-computer
interaction:
An outline of concepts from the literature

Anita Cremers

February 1993

Summary

In the present literature report an overview is given of the state of the art of research on the use of deixis in human-human communication as well as in human-computer communication. Deictic expressions refer to entities that are located in the extra-linguistic context, and generally construct a direct link between on the one hand the speaker, the moment and the place of the utterance and on the other hand the entity referred to. In many cases deictic expressions are accompanied by gestures that help the hearer to identify the object that was actually referred to. In fact, gestures and other non-verbal acts (e.g. the gaze direction) can serve as indispensable identification aids for the hearer. Despite of the vast amount of, mainly linguistic, literature on deixis, not much is known on the actual use of deixis in human-human communication, let alone in human-computer interaction.

Of the three main types of deixis, namely person, place and time deixis, place deixis is the most important one in the context of human-computer interaction. Place deictic expressions may be used to identify objects on a computer screen. The extension of linguistic reference with the possibility of using gestures (by means of a pointing device) could contribute to a decrease of the cognitive load of the user.

It is concluded that in the future empirical research on the collaborative referring process of two dialogue partners in a restricted domain has to be carried out, in order to gain insight in the way deictic referring expressions are used. In this type of research also the gestures that are used have to be taken into account. Moreover, the influence of the assumed knowledge of each of the partners on the nature of the used referring expressions has to be established. Finally, the acquired knowledge on the exact nature of this referential process can be used in designing a more user-friendly human-computer interface.

Contents

1	Introduction	5
1.1	Deixis	5
1.2	The DenK-programme	6
1.3	Report outline	7
2	Deixis: general aspects	8
2.1	Introduction	8
2.2	Defining and demarcating deixis	8
2.2.1	Definitions and terminology	8
2.2.2	Demarcation	10
2.3	Types of deixis	11
2.4	Uses of deixis	15
2.5	Basic deictic terms	17
2.5.1	Introduction	17
2.5.2	Use of deictic terms	18
3	Referential, deictic and anaphoric expressions	20
3.1	Referential expressions	20
3.1.1	Referring as a collaborative process	22
3.1.2	Reference problems	23
3.1.3	Direct and indirect reference	25
3.2	Deixis and anaphora	26
4	Place deixis	28
4.1	Introduction	28
4.2	Space	28
4.3	Functions of place deixis	30
4.3.1	The identifying function	30
4.3.2	The informing function	31
4.3.3	The acknowledging function	34
4.4	Cross-cultural aspects of place deixis	35
4.4.1	Location conception	35
4.4.2	Features of objects	36
4.5	Empirical studies of place deixis	38
4.5.1	Spatial descriptions	38
4.5.2	Route directions	39

5 Gestures in human-human and in human-computer interaction	41
5.1 Introduction	41
5.2 Gestures in human-human interaction	41
5.2.1 Introduction	41
5.2.2 Types of gestures during speech	42
5.2.3 Cognitive aspects	43
5.3 Gestures in human-computer interaction	44
5.3.1 Keyboard input and spoken input	44
5.3.2 Advantages of using gestures	45
5.3.3 Integrating gestures and language	45
6 Conclusions and future research	47
6.1 Conclusive summary	47
6.2 Future research	48

Chapter 1

Introduction

1.1 Deixis

This literature review is concerned with the use of deixis in human-human interaction in general and human-computer interaction in particular.

The term deixis is used for all linguistic expressions that are employed for referring to objects or concepts that can not be interpreted well when the hearer does not consider the extra-linguistic context in which these expressions are uttered. For example, when a speaker for the first time during a conversation refers to a certain person by using the expression *that man*, the hearer is only able to identify that particular man when he has access to the spatial context the speaker is apparently part of. The very same expression, uttered under other circumstances, most likely would have referred to another male person. Often, deictic utterances are accompanied by pointing gestures to make sure that the hearer can find out what person or object is being referred to.

It has to be stressed here that anaphoric references do not belong to the group of deictic expressions. Anaphora do not refer to extra-linguistic objects, but to, roughly speaking, linguistic elements that have been mentioned earlier in the discourse. So, anaphora indeed do refer, but in contrast to deictic expressions, they can be interpreted without considering the extra-linguistic context of the utterance. Also, the use of pointing gestures with anaphora would not serve any need.

In the field of linguistics a lot of fundamental research on deixis has been carried out. This research has particularly focused on trying to distinguish different types and functions of deixis and identifying their characteristics. Far less (empirical) research has been carried out on the actual usage of deictic expressions under different circumstances, either with or without pointing gestures, although in anthropology some field studies have been carried out to investigate the deictic behaviour of people living in non-western societies [Levinson 92].

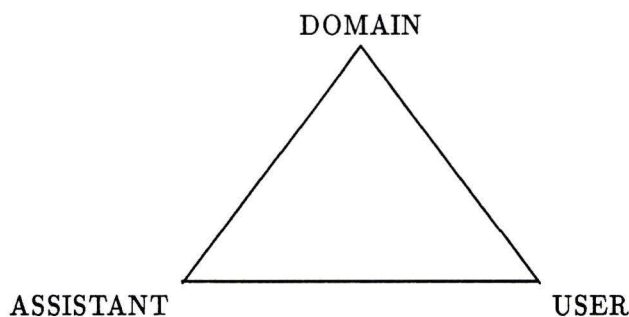
In the field of human-computer interaction research on deictic behaviour is even more rare. Although a lot of studies have been carried out on the possible uses of pointing devices in various computer applications, almost no

fundamental research on the most efficient and natural multimodal interface, particularly with respect to facilitate referring, has been initiated. This lack is partly due to technological constraints. The task to develop an interface that can handle and interpret input that comes in via several modes of communication at the same time is not a very straight-forward one. A more fundamental shortcoming, however, is the fact that insufficient knowledge is available on the character and the modes of communication people use to refer to objects under different conditions.

From the above it can be concluded that a vast amount of empirical research remains to be done on the actual use of deictic expressions and gestures in human-human as well as in human-computer interaction.

1.2 The DenK-programme

The *DenK*-programme¹ is an ideal framework for developing, testing and applying theories on deixis. Within this project a generic multi-modal interface is being developed that is able to conduct the communication between *user* and system (consisting of the *domain of discourse* and the so-called *co-operative assistant*) and at the same time constructs a knowledge base of the dialogue history. The situation that is encountered in a dialogue between a user and the system can be represented as a triangle:



One corner of the triangle represents the cooperative assistant, the second one the user and the third one the domain of discourse, i.e. the objects the assistant and the user are interacting about, that are represented on the screen. Both the cooperative assistant and the user have access to the domain of discourse. However, the modes of access may be different. The user may have visual access, may be allowed to point at objects on the screen or to directly manipulate them. He may also be able to communicate in natural language with the assistant. The assistant is able to manipulate

¹DenK stands for: '*Dialogvoering en Kennisopbouw*' (*Dialogue management and Knowledge acquisition*), a joined research programme of Tilburg University (Institute for Language Technology and Artificial Intelligence) and Eindhoven Technical University (including IPO) [Dialogvoering 89], [Ahn&Beun 91].

objects and to communicate in natural language with the user. Although the user can have the ability to perform direct manipulation on objects, he may also ask the assistant to perform these actions. Furthermore, he can ask the system to answer questions about objects. The assistant and the user have some common knowledge, but part of their knowledge may differ. For instance, the user knows which actions he wants to perform in the domain, and the assistant knows what possible actions can be performed, and also has exhaustive knowledge on the properties of the objects that are present.

Differences in possible modes of access and in knowledge between user and system can give rise to the use of different referring expressions. For instance, if the system assumes that an object on the screen has already been located by the user, it does not have to introduce it explicitly and a definite referring expression will be adequate. Also, if the system knows the user has no visual access to an object, e.g. because it is located behind another object, this object needs to be introduced far more elaborately. Finally the use of deixis can be facilitated by allowing the user to point at the screen while using a deictic expression.

At the present state of development of the DenK-interface insights from the literature and preliminary observations on referring behaviour in human-human interaction could be used for designing the dialogue component of the system. In a later stage these insights can actually be tested in a human-computer situation, and if necessary accordingly be adjusted or expanded.

1.3 Report outline

In this literature report an overview will be given of research on deixis, as far as it can be considered to be important for human-computer dialogues.

In chapter 2, the different types and uses of deixis and the basic deictic terms that have been described in the literature are listed and discussed.

In chapter 3, the related terms 'referential', 'deictic' and 'anaphoric' are described and a try is given to explain the differences and similarities between the three.

In chapter 4, place deixis, being the most appropriate type in our field of interest, is discussed extensively. Different functions of place deixis are described, as well as some cross-cultural aspects. Finally some empirical studies considered with reference to place are discussed.

Chapter 5 deals with gestures, and the ways in which they are used synchronously with speech. Some considerations on cognitive aspects of the combination of speech and gestures are provided. In this chapter also a short overview is provided on reference, linguistically as well as by means gestures, in human-computer interaction.

Finally, in chapter 6, some conclusions are drawn and suggestions for future research, particularly within the framework of DenK, are supplied.

Chapter 2

Deixis: general aspects

2.1 Introduction

In this chapter first a general definition of deixis will be given. Also the relationship of deixis with respect to some relevant disciplines will be outlined and the concept of context within this framework will be discussed. In the following sections the types and uses of deixis as described in the literature will be listed together with a short overview of the basic deictic terms in English.

2.2 Defining and demarcating deixis

2.2.1 Definitions and terminology

A definition of deixis that is mentioned often in the literature on this subject (e.g. in [Kryk 87]) is the one formulated by [Lyons 77]:

“By deixis is meant the location and identification of persons, objects, events, processes and activities being talked about, or referred to, in relation to the spatio-temporal context created and sustained by the act of utterance and the participation in it, typically, of a single speaker, and at least one addressee.”

In this definition Lyons has included all aspects that are involved in the interpretation of deictic expressions. Every deictic expression refers to (*locates* or *identifies*) some entity (*object, event, process* or *activity*) that is present in the non-linguistic context of the utterance of which it is a part. This context may be the physical environment in which the expression is being uttered, but it may also be an imaginary context that is being talked about. By speaking of the (non-linguistic) *spatio-temporal context*, Lyons excludes anaphora from the definition of deixis, because they refer to the linguistic context. Further, Lyons mentions a *single speaker* and *at least one addressee*. For a deictic expression to succeed, that is to be interpreted as having the intended meaning by the intended addressee, it is necessary that speaker and addressee to have a common spatio-temporal context. For

instance, the speaker may use his own location, the location of the addressee or the location of some object as a reference point for indicating the position of the person or object he is referring to (e.g. 'in front of me', 'in front of you' or 'in front of the house'). Also both interlocutors must be aware of the point of time at which the conversation is being held in order to understand expressions like 'yesterday' and 'next week'.

It is not a coincidence that the term 'deixis' is used for the phenomenon that is defined above. The Greek word *deiktikos* means namely *apt for pointing with the finger*. This is in a sense what is being done when someone is using a deictic expression. In order to locate or identify an entity that is present in the non-linguistic context it has to be pointed to by means of a linguistic utterance. In many cases actual physical pointing is involved in this process as well.

None of all possible deictic expressions can be used felicitously when the addressee neither knows when, where nor by whom they were uttered. Thus the meaning of these expressions depends on the situation in which they are uttered. This is what [Bühler 82] calls the *Zeigfeld* (the *indexical field*). He defines it as the relevant context of the utterance. The *Origo* (*origin*) is the anchoring point of this field. It includes the *I* (the speaker), the role or status of the participants, the *Here*, the *Now* plus the stretch of talk that is being produced. From this follows that deictic expressions are basically egocentric, because the speaker considers himself to be the origin of the indexical field.

[Lyons 77] gives a more elaborate definition of the indexical field. By the so-called *canonical situation of utterance* he means:

"the one-one, or one-many, signalling in the phonic medium along the vocal-auditory channel, with all the participants present in the same actual situation, able to see one another and to perceive the associated non-vocal paralinguistic features of their utterances".

Thus, with [Levelt 89], we can derive from this definition that the important elements in the spatio-temporal context are at least one addressee, an audio-visual scene, specific places or orientations of the interlocutors at the moment of utterance and the place of the utterance in the temporal flow of events. In the definition also the non-vocal features are included, such as pointing gestures and facial expressions. However, this definition does not account for the possibility of the situation of utterance being imaginary.

As [Brown&Yule 83] state, and as was already suggested in the three examples 'in front of me', 'in front of you' and 'in front of the house', the deictic centre (the *Origo*) is not a fixed point in space and time. The speaker might want to transfer it to the hearer's spatio-temporal situation and use deictic expressions with respect to this situation (e.g. in the expression 'in front of you' the entity referred to is probably not in front of the speaker). Also in different situations the same people can be named differently according to their deictic and/or social role of that moment (e.g. resp. addressee

or bystander and/or professor or student). [Brown&Yule 83] call the use of deictic terms that are not based on the Origo *secondary deixis*. However, the question arises whether in these cases one can still speak of deixis, because one of the basic characteristics of deixis is exactly the fact that there is a direct relation established between the speaker and the entity that is being referred to.

2.2.2 Demarcation

Deixis is considered to be a universal phenomenon. Among others, [Kryk 87] argues strongly in favour of this universality. She claims firstly that the phenomenon is present in all languages, secondly that no successful communication is possible without these indexicals and finally that both in language history and in the process of language acquisition deixis is the source of reference. By the last argument she means that historically deictic reference has developed earlier than other types of reference, and also that deictic reference is the first type of reference that children acquire.

As was already stated earlier, in the definition of deixis the non-linguistic context plays an important role. [Weissenborn&Klein 82] found that contextuality is considered to be one of the central links between language, perception and cognition. The meaning of a particular utterance can only be fully determined if the linguistic form of the utterance, together with the features of the speech situation as perceived by the speaker and the hearer and their (shared) general knowledge are taken into account. So deixis can be considered the most salient device to integrate these types of contextual information into a representation of meaning. Consequently linguistics, cognitive science and perception research can contribute to the understanding of deictic utterances.

With respect to linguistics in particular, deixis is a phenomenon that is balancing somewhere on the borderline between semantics and pragmatics [Levinson 83]. On the one hand it could be placed in the domain of pragmatics, because deictic expressions are a typical reflection of the context-dependency of utterances. Their meaning can only be properly determined after considering the context they are uttered within. On the other hand, a semantic component is necessary as well in order to cover the non-contextual part of the meaning of a deictic expression, namely the truth-conditional aspects. In a sense almost all possible utterances are of course context-dependent. As [Miller&Johnson-Laird 76] argue: "There is a strong argument that interpretation is always dependent on context, but for some words dependence is unavoidable". They proceed by stating that these words are exactly the deictic ones and by citing [Rommetsveit 68] that these "deictic words introduce particulars of the speaker's and the hearer's shared cognitive field into the message".

2.3 Types of deixis

The general definition of deixis that is given above does not account for all of the different types of deixis that may occur. [Lyons 77] mentions persons, objects, events, processes and activities that may be referred to, but he does not provide an exhaustive list of types of deixis. [Levelt 89] provides an appropriate example including the most important types of deictic expressions:

Arnold: "Have you seen this?"

(He points to a Min dynasty vase, which displays a horrifying pattern of fresh cracks.)

Betty: "You asked me that before, but I haven't been here since yesterday."

In this brief dialogue instances of person, social, place, time as well as discourse deixis are employed, which will be discussed below.

1. Person deixis

Person deixis is employed in the words 'you' (by Arnold and Betty), 'me' and 'I' (by Betty). By using these words the participants indicate which person with respect to themselves they refer to. Note that the 'you' uttered by Arnold refers to another person than the 'you' used by Betty. So the meaning of person deictic term varies with the different speakers that use it.

2. Social deixis

In personal pronouns an element of social deixis might be included too. In English this is not so obvious, but in many other languages people use different addressing terms depending on their social relationship with the addressee. In Dutch for example, when addressing an older person or someone possessing a higher rank, it is common to use the pronoun 'U' (written in capitals as opposed to the rest of the personal pronouns). Roughly speaking, in most of the other cases 'je' or 'jij' is employed. Another example is Japanese, that has a far more elaborate social deictic system than the Indo-European languages. Here different terms are used depending on the sex and social status of the speaker and the hearer.

3. Place deixis

Place deictic words in the example dialogue are 'this' (by Arnold) and 'here' (by Betty). By using these words Arnold and Betty select a particular location included in the speech situation. Arnold is referring to a very specific area, which is supported by a pointing gesture. Betty, on the other hand, by uttering 'here' includes a far larger area of reference. She might mean 'this corner of the room', 'this room' or even 'this building'.

The question can be asked why in Arnold's case the term *object deixis* is not more appropriate than place deixis, because Arnold is pointing

at an object and not at a place. However, in general this assumption is not right, for three reasons. First, in the example Arnold is pointing at a very specific area of an object, namely the crack in the vase. Thus pointing at an object does not mean that always the object as a whole is being pointed at; only a part of it can also suffice. Second, pointing at the object as a token of a class of similar objects can be carried out. Then not the individual object is important, but the type of object it represents instead. The third reason for using the term place deixis instead of object deixis is that the former is a more general term, because at a certain point in time objects are always located at some place. By pointing at the object one is automatically pointing at the place where the object is located. Moreover, it is also possible to point at places where no object is present at all.

4. Time deixis

Time deixis obviously comes forward in the words 'before' and 'yesterday' (both Betty). Also in the verb tenses that are used time deixis plays an important role. Arnold and Betty are perfectly able to interpret these time deictic expressions correctly, because they are both aware of the point of time at which they are uttered. In other words, the conversation is anchored in the time. We, as readers, do not have access to this information, and accordingly we can not know which day is meant by 'yesterday'. Like us, as readers, the hearer does not necessarily have to know the absolute point of anchorage to be able to interpret time-deictic expressions. The relative meaning of 'yesterday' often gives sufficient information for interpreting the utterance.

5. Discourse deixis

The last remaining deictic term in the example dialogue is 'that' (Betty), which is an instance of discourse deixis. With 'that' Betty refers to the question as a whole that Arnold asked. So discourse deixis always implies reference to a part of the preceding or following text that the speaker is uttering, but does not include anaphoric referring terms.

As opposed to other forms of deixis, discourse deixis does not refer to non-linguistic contextual entities, but to the contents of utterances or underlying speech acts that have been used earlier or will be used later in the discourse. So discourse deixis is not a very clear type of deixis. Since these terms are neither really deictic, nor really anaphoric it is a matter of preference or pragmatism where to classify them.

[Rauh 83a] also finds the category of discourse deixis problematic. In her view discourse deixis is not a deictic type (or a *deictic dimension*, as she calls it) but a way of using deixis; a *deictic use*. In the case of discourse deixis the situation of the speaker is independent of any aspects of his ego that are relevant in all other deictic dimensions (like his location or his social status). This may be true, although Rauh does not consider the time aspect. In discourse deixis the moment

of an utterance is important, because the flow of the discourse also operates in the time dimension. Thus references to discourse elements always apply to something that already has been said in the past or something that will be said in the future.

The various possible uses of deixis, in Rauh's view, will be described in section 2.4.

Another even more typical deictic utterance than the previous example is the following sentence, provided by [Fillmore 75], that has to be imagined as being written on a little paper found in a bottle that was floating on some sea:

'Meet me here at noon tomorrow with a stick about this big.'

The finder of this note will never be able to carry out this directive properly if he neither knows where, when nor by whom it was written and what the size of the intended stick should be. He can not even know whether he is the intended addressee or not. Probably he would be too late anyway, because it is likely that the bottle has been in the sea for more than one day already. Of course, in an everyday conversation like the one between Arnold and Betty, people usually take care not to use deictic expressions when they know the addressee is not able to anchor them in the conversational setting. Otherwise, their contribution would fail to be successful.

In these two examples not all possible types of deixis are included. [Rauh 83a] mentions several other types, which she calls deictic dimensions. After [Schmid 72] she lists next to local (place), temporal (time), personal (person), social and discourse dimensions, the categories of *modal*, *topical*, *relevance* and *emotional* dimensions. It must be noted, however, that these so-called dimensions do not belong to the group of the traditional, well-known types of deixis that are described above. Sometimes, the exact definitions are even not really easy to grasp, and examples are often not very straightforward. The basic idea of taking these dimensions as types of deixis, is the feature of deictic expressions to constitute a relation between the deictic origin and some entity that is being referred to. According to Schmid, when such a relation can be isolated deixis is present. The four types of deixis (deictic dimensions) that have not been discussed yet will be briefly described below.

6. Modal deixis

Rauh, after Schmid, claims that a number of modal meanings can be seen as deictic categories. By using a modal expression a relationship is established between the speaker and extra-linguistic modes of being (like for example the realities the speaker wants, knows or believes in). Schmid calls this relation deictic because it is established from the speaker to the world, in this case a mental world.

7. Topical deixis

According to Schmid, and reported on by Rauh again, topical deixis is determined by the universal case system. The allocation of the topic of an utterance to some clause by the speaker determines to which other clauses are given which cases. Since the topic can be considered identical to the speaker's point of orientation, the relation between the topic and the entities expressed in other clauses can be seen as deictic. In different languages this topic is expressed by different means. For example, in German the topic is given the Nominative case and the entity that is in direct (deictic) relation to the topic is given Accusative case, like in:

Die Frau verkauft dem Mann Blumen für Zehn Mark.
(*The woman sells the man flowers for ten marks.*)
(*'The woman sells flowers to the man for ten marks.'*)

Here 'die Frau' is the topic of the sentence, and represents the point of view of the speaker, thus is given Nominative case. 'Blumen' is directly related to 'die Frau', because this is what the woman is selling. Thus 'Blumen' is given Accusative case. The case system can be seen as expressing the deictic point of orientation of which the speaker is the center.

8. Relevance deixis

Relevance deixis is formed by a combination of topical and social deixis, and is restricted to the order of enumeration of entities (objects and persons). The enumeration of entities can be interpreted as an icon of place deixis with the point of orientation being represented by the first position in the utterance. The most relevant entity is in that case mentioned first. The entity that is directly related to the first one is mentioned second and so further. The translation of the German example under 7 into English illustrates this. Here 'the woman' is mentioned first, followed by the 'flowers' that are directly related to 'the woman'. The social part of relevance deixis is that for the sake of politeness people normally say for example 'you and I' instead of 'I and you'; so the linear order in the sentence reflects the social order.

9. Emotional deixis

The last type, emotional deixis, is considered to be a problematic one by Rauh. An example is (after [Fillmore 82]):

'Susan, get that snake out of this house!'

Fillmore claims that in this case 'that' is used, because it indicates an emotional distance between the speaker and the 'snake'. In contrast, 'this' indicates emotional proximity to the 'house'. According to [Lyons 82], uses of 'this', 'here' and 'now' indicate the speaker's

subjective involvement. The problem lies in the fact that on the other hand, Fillmore shows that the use of 'that' may sometimes indicate a close relation between the speaker and the addressee, see for example:

That left front tire is pretty worn.
Your left front tire is pretty worn.

In this example the first sentence is considered to be uttered in a more familiar register than the second one, and thus indicates more emotional involvement. So judgments about these kinds of sentences seem to be rather speculative. A way out of these speculations may be offered by the intonation of the utterances. A suggestion would be that intonation plays an important role in emotional deixis. By looking at the problem from this angle a solution can be found in stating that emotional distance may not be a result of using 'that' but rather of placing a strong accent on 'that'.

2.4 Uses of deixis

Depending on the situation of utterance and the intentions of the speaker a deictic expression may serve seven different functions [Rauh 83a], that will be described below.

1. *Demonstratio ad oculos* ([Bühler 82])

In this use the speaker as well as the objects that he relates to himself by means of deictic expressions are actually present at the situation of utterance. This use can be considered the basic deictic use, because this is the situation one thinks of first when trying to explain deixis. The name stems from the fact that in this use deictic expressions can be accompanied by gestures, that have to be accessed visually. Since acoustic signals are possible too, the term *demonstratio ad oculos et ad aures* is sometimes used instead.

2. *Deixis am Phantasma* ([Bühler 82])

Here the center of orientation but not the related objects are part of the canonical-situation-of-utterance. By means of the utterance the speaker creates an imaginary world. In this case the deictic expressions do not relate to entities in the real world, but to those in the imaginary world.

3. *Deixis im Vorstellungsraum* ([Ehlich 83])

Here the center of orientation as well as the related objects are excluded from the canonical situation of utterance. The encoder imagines himself to be located in an imaginary space, like in:

'I had heard Mr. Rochester assign him an apartment below – what had brought him here?'

In this utterance 'here' is not referring to the place of the utterance, but to the place that is created or imagined in the utterance. Also Mr. Rochester is part of the same created world. A variant of this kind of use comes forward when the speaker establishes a center of orientation independent of his own person, but with respect to someone else, like in:

Yesterday Barbara said: "I shall see you tomorrow".

Here the center of orientation in the citation is represented by Barbara. All deictic expressions she utters have to be interpreted with respect to her spatio-temporal situation and not to the narrator's one. Of course, 'yesterday' must still be interpreted with respect to the time of the narrator's utterance.

4. Discourse deixis

Discourse deixis is, according to Rauh, a deictic use rather than a type of deixis. In discourse deixis the center of orientation does not correspond to the real or the reconstructed external situation of the speaker, but it corresponds to his momentary situation within the course of a text. Because the extra-linguistic situation does not have to be accounted for here, discourse deixis can not be called a type. Instead it can be called a use, because the deictic terms are used to carry out a similar function.

5. Analogous deixis

By using analogous deixis the center-of-orientation is not established in a real space or in a space reconstructed cognitively, but is represented by a concrete object which functions as an analog (for example a map), for example while pointing at the map one can indicate where a certain projectile in reality has exploded:

The bomb was dropped here.

6. Non-egocentric deixis

[Rauh 83a] states that deixis can be used in a non-egocentric way as well. A speaker can explicitly express a relatum different from himself, for example in:

The book is on top of the closet.

Here 'on top of the closet' is assigned the role of relatum. The location of the book can be determined without knowing the perspective nor the location of the speaker. Note that non-egocentric deixis is different from secondary deixis (following the definition by [Brown&Yule 83] in section 2.2.1). Brown and Yule define secondary deixis as occurring

when the Origo is shifted from the speaker to the hearer. Here no Origo-shift occurs, but the object is referred to with respect to some other object. However, again we can wonder whether we are really dealing with a deictic expression here. If there is no relation established between the speaker and the object he is referring to, it is strange to still call the expression deictic.

7. Anaphora

The referents of anaphora are linguistic units. However, they do not determine relations in an egocentric-localistic manner between segments of discourse and a discourse deictic point of orientation, but they are restricted to *syntaktisches Zeigen* (*syntactic pointing*) [Bühler 82]. This means that the referents are linguistic units that can be classified according to syntactic properties and whose classification corresponds to that of the respective anaphoric expressions. The essential function of anaphora is to express coreference between these expressions and other linguistic expressions. However, it is unclear why anaphora should be called deictic, because they do not relate to the extra-linguistic context of the utterance.

For an adequate use of deictic terms it is important to make a distinction between the *coding place or time* and the *decoding place or time*. An utterance that is produced at one place but received at another, like in a telephone conversation, may include deictic expressions that can not be understood at the place where the receiver is located. Letter writing illustrates the same problem in the time dimension. The receiver has to find out on which day the letter was written in order to be able to understand the time deictic expressions that the sender has used.

2.5 Basic deictic terms

2.5.1 Introduction

The examples in this chapter have already shown that the group of English basic deictic terms consists of the *pronouns*, the *demonstratives* and the *adverbs of place and time*. Time deixis can also be expressed by the *verb tenses*. In the case of place deixis some *verbs* play a deictic role too (e.g. the verbs 'come', 'go', 'bring' and 'take'), because these verbs presuppose the location of the speaker. Further it is claimed ([Rauh 83a]) that deixis may appear in modal verbs, in the general case system and in the order of mentioning entities.

Of course, the deictic terms mentioned so far only account for English. In other languages deictic aspects are sometimes expressed by other grammatical categories. Some deictic categories that do not exist in English may be available in another language. In several languages, for example, there are three terms available to indicate distance from the speaker, while in English there are only two ('here' and 'there'). Those languages have an

additional term to indicate a medium distance, which means roughly not here, not there, but somewhere in between, usually in the neighbourhood of the addressee. According to [Lyons 77] there is a big difference between different language communities in the use of deixis, which is perhaps most striking in place deixis. Still some features are more basic than others and should be found in every deictic system. This means for example that every language should at least be able to distinguish between 'here' and 'there'.

2.5.2 Use of deictic terms

Basic deictic expressions are not used deictically in all cases. Nor is it the case that for an expression to be deictic it has to be part of the enumeration given above.

[Levinson 83] provides a survey of the ways in which deictic terms can be used, which is shown below:

1. deictic a. gestural
 b. symbolic
2. non-deictic c. non-anaphoric
 d. anaphoric

Deictic gestural usages can only be interpreted if the hearer can see what the speaker is referring to, for example when a speaker is using a demonstrative pronoun together with a pointing gesture.

For deictic symbolic usages only knowledge of the basic spatio-temporal parameters of the speech event is necessary. So no specific knowledge of the location of objects is required.

Non-deictic non-anaphoric usages do neither refer to some object present in the canonical situation-of-utterance, nor to an entity that was introduced earlier in the discourse. This usage seems to be a very language-specific one, because in other languages than English the same usage can be expressed without using deictic terms.

Non-deictic anaphoric usages pick out as referent the same entity (or class of objects) that some prior term in the discourse picked out as well.

Examples of these different usages are:

- a. *Not that one, idiot, that one.*
- b. *That's a beautiful view.*
- c. *Oh, I did this and that.*
- d1. *I was born in London and I have lived there ever since.*
- d2. *I cut a finger: this one.*

Within these examples d2. is a special case, because as a non-deictic anaphoric usage ('this' refers to the entity that 'finger' refers to as well) the utterance still has to be accompanied by a presentation of the relevant finger, which suggests a deictic usage.

In Levinson's view anaphora are non-deictic referring expressions. In the preceding section it was shown that [Rauh 83a] includes anaphora in a list of

deictic uses. Which classification to choose for is of course a matter of definition. However, the most important distinction that should be accounted for is the one between anaphoric use and non-anaphoric use, because this bipartition reflects the essential difference between intra- and extralinguistic reference.

In the following chapter the distinctions between reference in general, deixis and anaphora will be discussed more elaborately.

Chapter 3

Referential, deictic and anaphoric expressions

The terms reference, deixis and anaphora are often used in interrelated contexts so that confusion might arise easily. In order to make clear the distinction between the three terms their meanings will be described more elaborately in this chapter.

3.1 Referential expressions

Most authors agree that reference is the most general term of the trio reference, deixis and anaphora. For example [Clark&Marshall 81] formulate in their so-called *location theory* the concept of definite reference as follows:

“In making a definite reference with term *t* sincerely the speaker intends to refer to: the totality of objects or mass within a set of objects in one possible world, which set of objects is such that the speaker has good reason to believe that on this occasion the listener can readily identify uniquely mutual knowledge of the identity of that set such that the intended objects or mass in the set fit the descriptive predicates in *t*, or, if *t* is a rigid designation, are designated by *t*.”

A simple example may clarify this not so simple definition. When a speaker uses the definite referring expression ‘the bicycle with the red saddle’, he refers to a specific bicycle within the set of all existing bicycles. The speaker uses this expression because he supposes that the hearer knows what kind of objects belong to the set of bicycles. He also assumes that the hearer by interpreting the predicate ‘with the red saddle’ is able to uniquely pick the intended bicycle out of the set of possible candidates to fit the description.

The mutual knowledge that the interlocutors are using can be derived from three different situations, namely *community membership*, *physical co-presence* or *linguistic co-presence*.

- In the situation of community membership a speaker can use *proper names*, because it is assumed that within a certain community people

know which person, place or prominent event is referred to when a particular name is used. Also, the use of certain technical terms that are considered to be part of the knowledge of people that belong to a certain group or profession is allowed. [Hawkins 84] supplies an example of someone talking to a linguist and thereby using the term 'the deep structure'. This expression would probably not have been appropriate when the hearer had appeared to be a non-linguist. Hawkins concludes that there are pragmatic conditions governing the appropriate usage. It is a task of the hearer to recognize the pragmatic set within which the object referred to exists and is uniquely identifiable as well.

- In a situation of physical co-presence a speaker can use *deictic expressions*, because both speaker and hearer are able to find out which objects or what persons are being referred to.
 - In the case of physical co-presence *demonstratives* can be used when there is a situation of *visible situation use*, for example in 'Look out for the/*that* table'. In this utterance the table has to be present (and perhaps visible) at the moment of utterance. So here it is appropriate to use either 'the' (definite article) or 'that' (demonstrative).
 - When there is a situation of immediate situation use, for example in 'Beware of the/**that* dog', no demonstrative can be used. In these situations the object referred to does not have to be present at the moment of utterance, thus it is not demonstrable. A sign containing this sentence also applies when at the moment of reading the dog is not present. The warning still works, because the dog may arrive at any moment.
- The last situation is a situation of linguistic co-presence. Then the speaker and hearer know which entities have been introduced in the foregoing conversation, and *anaphora* can be used to refer to these entities. For example, in 'I bought a lathe, but the machine didn't work right' the anaphor 'the machine' is used to refer to 'a lathe', which was introduced linguistically in the first part of the sentence.¹

In summary, two important sources of knowledge are used for interpreting a definite referring expression. In the first place perception is used. This source is needed for interpreting referring expressions in a physical co-presence situation. The second source of knowledge is cognition, either acquired by means of community membership or linguistic co-presence. There is not really an essential difference between the two sources of knowledge. The speaker can only be more certain of the presence of the former source than of the latter, since it is always difficult to know exactly what someone else knows. In general, the speaker can never be really certain whether he

¹In this example 'the machine' can only be considered an anaphor if one acknowledges the existence of *full anaphoric NPs* [Deemter 91].

is using an appropriate expression or not. He only uses a definite referring expression, because he **assumes** that mutual knowledge is available.

3.1.1 Referring as a collaborative process

From what is asserted in the preceding section one might conclude that the act of referring within a conversation is a task belonging exclusively to one interlocutor at a time. However, in many cases this assumption is incorrect. As [Clark&Wilkes-Gibbs 86] state, in order for each reference to be successful the interlocutors should apply collaborative procedures for establishing the mutual belief that one of them has identified and understood the other's reference. So, if one interlocutor presents a referring expression then the other has to make clear, explicitly or implicitly, whether it is accepted or not. If not, another turn should be carried out, and, if necessary, another one, until both interlocutors accept the originally used expression, and mutually know that the other has accepted it too.

[Auer 84] also considers a conversation in general and reference in particular to be a collaborative interaction. Beside the fact that speakers expect hearers to indicate whether they accept a referring expression or not, speakers also rely on their hearer's readiness and capability to fill in additional features of the referring expression which they have not mentioned explicitly. This means on the one hand that referential items do not need to be complete on the first mention, because the hearer is expected to collaborate in finding the right referent and fill in the missing part. But on the other hand this does not mean that the referring party can fully rely on the hearer's willingness to fill in whatever misses. To make sure that the referring process is carried out as efficiently as possible the speaker has to assess the hearer's mental state before he selects the referring expression in order to be able to choose the most effective one.

The following example (from [Schegloff&Jefferson&Sacks 77]) should make clear how a hearer can supply additional features of a referring expression:

B: How long y'gonna be there?

A: Uh- not too long. Uh just til uh Monday.

B: Til- oh jih mean like a week f'm tomorrow.

A: Yah.

In this dialogue *A* uses the referring expression 'Monday'. *B* obviously is not certain which Monday is meant and for the time being interprets it as 'a week from tomorrow', thereby filling in the missing information. Probably *B* assumed that *A* would have said 'tomorrow' if he had really meant the next Monday. Subsequently *A* confirms *B*'s interpretation, indicating that the act of reference has succeeded.

3.1.2 Reference problems

Although interlocutors are always trying to reach a state of (partial) mutual knowledge, reference problems might still occur in conversations.

According to [Auer 84] misfits between the referring expression and the object that is intended to be referred to may be noticed either by the speaker or by the hearer. The referring party may have a positive or a negative evaluation of the appropriateness of a referential item that was used. In the case of a negative evaluation he might provide an addition before the receiving party has had any chance to react to the first utterance. The hearer may feel that there is either a fit or a misfit between the referential item and his background knowledge. An example of a misfit was given in the preceding section. However, often misfits will simply go unnoticed. Participants who do not know what is meant by a referring expression may rely on the wait-and-see-principle in the hope that they will find out later. Participants who already know what is being referred to may refrain from protesting, because they do not want to interrupt the on-going sequence. This indicates that every time when a misfit occurs the participant judges whether it is worthwhile to interrupt the flow of discourse. Previous experience with conversations might have indicated that usually later in the conversation everything will become clear.

[Goodman 86] discusses the possible causes of misfits, which he calls *misinterpretations*. An expression might for instance have a wrong specificity or give a wrong focus clue. Also a wrong context might have been set up or a bad analogy might have been used. These causes of misinterpretation as distinguished by Goodman will be described below.

1. Erroneous specificity

The term 'erroneous specificity' indicates that a referential expression is either under- or overspecific. In case of *underspecificity* the expression can turn out to be ambiguous, which is a source of imprecision. *Overspecificity* means that more details than strictly necessary are provided, which may cause confusion on the part of the hearer. Goodman provides an example excerpt of a dialogue between an expert and an apprentice where the apprentice has to assemble a toy waterpump by following instructions from an expert. When the expert has communicated some features of a part of the pump the subject already reaches to grasp it, but hesitates when the expert keeps on adding new features.

However, overspecificity does not in general cause such negative effects like confusion, as [Pechmann 84] shows. Pechmann found in some discrimination experiments that in general people tend to overspecify when they refer to an object. This means that in many cases people use more descriptive features to discriminate an object from other objects in the environment than is strictly necessary. In his experiments he did not observe any confusion on the part of the participants, although this would have been the prediction of Goodman. An explanation for the observed behaviour could be, as put forward by Pechmann, that

people use an incremental strategy: they start naming features before they realize whether these are discriminating or not. Once they have uttered the whole referring expression and it appears to be overspecific, they can not start all over again, so they leave it the way it is.

2. Improper focus

A speaker may also cause misreference by using an improper focus clue. Focus confusion happens to occur when the listener is led to believe that a focus shift has occurred, but that in fact it did not. Also the speaker may have omitted a focus shift indication which caused confusion on the part of the hearer. An example of the latter case is, again in Goodman's water pump protocols, the situation when a specific part (the 'tubebase') is in focus, and the expert fails to indicate that a focus shift has occurred to another part (the 'spout'). When the expert asks the apprentice to remove 'the plastic' piece (meaning the spout), the apprentice starts to take off the tubebase.

3. Wrong context

The selection of a wrong context can also become a source of misreference. The context includes the intention of the discussion and the set of objects relevant to that discussion, though not attended to currently. Two people may for instance share the same context, but have different focus assignments within it. The explanation of the difference between focus and context, as Goodman provides it, is a matter of definition. Context can also be seen as a higher level form of focus. In that case, the difference between the two notions is just a gradual one. The kinds of problems that can occur because of context inconsistencies are similar to those for focus problems. The speaker might set up or use one context for a discussion and then proceed in another one without effectively letting the hearer know of the change. Also the hearer may feel a change in context has taken place when in fact the speaker never intended one. Finally the listener might fail to recognize an indicated context switch by the speaker.

4. Bad analogy

When the speaker uses a bad analogy this may cause misreference for three reasons. Firstly the analogy may not be specific enough. It is also possible that the mapping between the analogous object and something in the environment is too difficult to establish. Thirdly, the analogy might be too specific, confusing the hearer because none of the available referents appear to fit it. Examples of overspecificity in Goodman's water pump protocols are descriptions for pieces like 'hippopotamus face' and 'champagne top sort of', which puzzled the hearer completely.

Reference problems can also occur when the object referred to has an inherent complexity or when it is difficult to distinguish the object from the

surrounding ones. In these cases it is even more important for both interlocutors to come to an agreement on what object is meant by an expression. [Clark&Wilkes-Gibbs 86] found that in the case of complex objects this collaborative procedure may take several turns before the mutual belief that one of the participants refers to a particular object is achieved.

3.1.3 Direct and indirect reference

Reference does not always have to occur in an obvious direct way. *Direct reference* occurs when a more or less 'obvious' link can be made between the referring expression and the entity which it refers to. For instance, according to [Clark 77], if the relation is one of the following: *identity*, *pronominalization*, *epithetic* or *set-element*, there is no need to apply an inferential procedure in order to find out the referential link.

In cases of *indirect reference*, when there is no direct link between the referring expression and the object referred to, there is a need for *bridging*. The hearer has to construct an implicature in order to find out the nature of the relationship between the referring expression and the referent. Clark asserts that the nature of these relations may be *association*, *characterization* and *reasons, causes, effects* and *certain similarities*. Examples are 'the elephant' for a fat, clumsy person (based on similarity) and 'the accident' for a person with crutches (based on the cause of this state).

[Miller 82], while discussing some philosophical problems in the theory of demonstrative reference, uses the term *deferred ostension* ([Quine 71]) to describe indirect reference. In his paper he points out, following [Kaplan 77], that the meaning of a directly referring deictic word is built up out of two parts, a variable and a constant part. He calls the variable meaning of a deictic word *content* and the constant meaning *character*. The content is sensitive to context; it may refer to different individuals or objects in different contexts of use. For instance, 'there' points to different locations in different contexts. The character is insensitive to context. This part of the meaning represents the fact that all speakers use that particular word in the same way. For instance, 'there' is always used to refer directly to a demonstrated location. The character of a deictic expression presents a problem, because not in all cases a direct reference is made. In the case of deferred ostension the referent of a deictic expression is not always the object the associated demonstration is exactly referring to. For example, when someone is explaining the colour green and points at grass, he does not mean to refer to the grass, but to the abstract concept 'green'. However, in general people have no problem to create the relation between the referring expression and the intended referent. Miller names several inferences that people might have to make, namely those from an individual to a property of that individual, from an individual to all individuals of that type or from a part of an object to the object as a whole (see for instance the example of the crack in the vase in section 2.3). In these cases Kaplan speaks of *extended direct reference*. Then a so-called referring function should be inserted between the object referred to and the referent of the demonstrative

term. The referring function has to perform the same tasks as the inferences mentioned above.

3.2 Deixis and anaphora

In the previous general section on referential expression, the terms deixis and anaphora have been mentioned several times. This is not a coincidence, because both are instances of referential expressions.

[Kryk 87] explains that historically the (deictic) demonstratives ('this', 'that', 'here', 'there') are the primary means of referring. These words are strongly related to the physical act of pointing. But, according to Kryk, this does not mean that deixis is the more general term with respect to reference. The phenomenon can be categorized as an instance of *exophoric reference*. This means that deictic terms, as a subclass of referential expressions, accomplish reference to objects in the non-linguistic environment.

In contrast, anaphora are instances of *endophoric reference*. This means that anaphoric expressions refer to intra-linguistic entities. Kryk, following [Bühler 82], who calls anaphora "the most common way of pointing", therefore considers anaphora to be a subset of deixis. Consequently, since deixis is a kind of reference, anaphoric expressions are too. So all anaphoric expressions are deictic, and therefore referential, but the reverse does not hold.

Both demonstratives and pronouns can be used deictically as well as anaphorically. In the case of deixis, demonstrative expressions must be used accompanied by *ostension* (pointing). When they are used as anaphora ostension is not necessary, and in most cases not even possible. The difference between pronouns used deictically and anaphorically is not always easy to discover. In spoken discourse however, the intended use is strongly determined by stress and intonation. So, whether 'he' refers to a male person that was introduced earlier in the discourse, or to some male that has not been mentioned before, is easy to find out if the sentence is uttered. In the former case no stress will be placed on 'he', while in the second latter case stress is added strongly.

The link between anaphoric and deictic use can be seen clearly in discourse deixis. According to [Ehlich 82] discourse deixis (which he calls *textual deixis*) does not have the same function as anaphora. He distinguishes between a deictic and an anaphoric procedure to illustrate his point. When using a *deictic procedure* the speaker focusses the hearer's attention towards a specific item which is part of the *deictic space*, i.e. the non-linguistic context wherein a deictic reference would be significant. An *anaphoric procedure* is applied by the speaker when a certain place or object is already introduced and is referred to again. In the latter case the hearer is instructed to treat a previously verbalized element as remaining in focus.

In the case of discourse deixis the used procedure is obviously not bound to the actual speech situation, but to the text that has been uttered thusfar. Here the applied procedure could be called the *anadeictic procedure*. This

procedure can be used on three occasions. In the first place it can help structuring the text and presenting the identification of its parts and sub-parts. Secondly, it can mark comments on preceeding or succeeding parts of the text. Finally, it can orient the hearer's attention to specific sections that are being taken up.

Chapter 4

Place deixis

4.1 Introduction

Of the three main types of deixis, i.e. person, place and time deixis, place deixis is the most important one within the framework of DenK¹. For the system it is necessary to be able to make the right connections between the utterances and manipulations of the user and the objects on the screen. In order to indicate objects and locations on the screen the user will expectedly use a large amount of place deictic terms. Therefore we will treat place deixis in this report more extensively compared to other types of deixis.

In this chapter first some general remarks on space will be given. Then the functions, the cross-cultural aspects and some empirical studies of place deixis will be treated successively.

4.2 Space

In order to use place deictic terms correctly we have to know the characteristics of the space that surrounds us and the way objects can be located or moving in it. In natural language space can be described in a system of coordinates having three axes: the left/right axis, the front/back axis and the up/down axis. The *left/right axis* is in essence *egocentric*, because it is based on the bilateral asymmetries in the workings of our own bodies. For each person is 'right' the side of his own right hand, and 'left' the side of his left hand. This remark is not trivial, which can be demonstrated by the fact that some people have problems distinguishing between left and right, and actually have to look at their own hands to find out.

The *front/back axis* is *anthropocentric*, in the sense that it is based on the inherent asymmetries of a reference object, for which the human body is often used as an analogy. The intrinsic front of an object is usually the side that contains most of the perceptual apparatus (either literally or figuratively), and/or the side characteristically lying in the direction of motion, and/or the side that is characteristically oriented to the observer

¹A brief outline of the DenK-system has been sketched in section 1.2.

([Miller&Johnson-Laird 76]). The side that is characteristically oriented towards the observer is normally the one that contains most of the functional parts, e.g. the drawers of a desk. A well-known phenomenon is the influence of the static or dynamic nature of an object on the perception of the location of its front side or its back side. The static or dynamic nature of the referent is an important determinant of the choice of the referring expression. When two balls *A* and *B* are located one behind the other in front of the speaker, he will say that '*A* is in front of *B*'. However, when both balls are moving away from the speaker, he will say '*A* is behind *B*' ([Hill 82]). This means that objects without an intrinsic front acquire a front by moving; the front is the most forward side of the object in motion ([Levelt 83]).

The *up/down axis* is neither ego- nor anthropocentric, but it is founded on the *relations that exist in the environment*, independent of ourselves and the objects referred to. Normally 'down' is seen as the direction of gravitation, and 'up' the opposite way.

We have to convert the features of the space, which we normally perceive visually or auditory, into a linguistic description that corresponds to the perceptual mode as close as possible. [Fillmore 82] calls the expressions that are used to indicate a certain place *locating expressions*. A locating expression associates a *figure* with a *place* through reference to a *ground*. This happens for example in:

The cat is on the mat

Here reference is made to a figure (the 'cat'), of which the place is indicated by referring to the ground (the 'mat'). So, by means of locating expressions, the speaker makes explicit or implicit reference to a place which can be identified as a neighbourhood, surface or interior of an entity near, on, or in which things can be situated, or as a set of coordinate values capable of specifying an object's location. If there is actually a figure situated at a certain place, one or more of the identifications listed above can serve as a ground for associating the figure with the place. For example, in its turn the cat on the mat can act as ground, e.g. in 'The dog is left from the cat (on the mat)'.

When the locating expressions are deictic, the ground is the speaker's (or possibly the hearer's) body. The role of the speaker as ground can be threefold:

1. The place being indicated is the current location of the speaker (e.g. 'John is here', where John is in the place where the speaker is currently located). Extensions of this simple case are found when either the speaker is the zero point of a system of coordinates whose orientation is provided by the environment (e.g. 'He's right upstairs', where the direction of the pull of gravity indicates the place where 'he' is) or the speaker's body generates a system of coordinates which moves and rotates as the speaker's body moves (e.g. 'It's up ahead, over there to the left', where the speaker's body indicates in which direction to

move).

2. The place being indicated is not the current location of the speaker. The speaker can present a stance, gesture, or non-incidental bodily orientation that can direct the hearer's gaze to the indicated place or figure (e.g. a pointed index finger). These presentations are called *indexing acts*. When they are accompanied by a deictic expression, it seems that the speaker wants to tell the hearer: 'Notice what I'm pointing at!'
3. The position of the speaker and the hearer define a field of shared visual experiences. In a number of languages, a difference between demonstrative references to objects that are located within vs. without the shared visual field can be distinguished.

So, if the speaker is the ground, the location of the speaker and his outlook on the world can determine the description of the orientation of the objects around him. Deictic terms that express this orientation are called *primary deixis* ([Fillmore 75]). An example of primary deixis is: 'the side of the tree facing me' resp. 'this side of the tree' or 'the kitten in front of the tree' (with respect to the position of the speaker).

There are also situations where the speaker takes into account where the addressee is located in choosing the appropriate expression. The kinds of deictic expressions that are used here are called *secondary deixis*. An example of this possibility is: 'on the right side as you face it'. Note that this definition is the same as the one [Brown&Yule 83] used in section 2.2.1. Thus the same objection we raised there holds for this definition too. In section 4.3.2 a way out of this problem will be provided by [Levelt 89].

4.3 Functions of place deixis

According to [Fillmore 82] and [Levelt 89] place deictic referring expressions can serve three different functions. They distinguish the *identifying*, the *informing* and the *acknowledging* function, that will be described respectively in the three following subsections.

4.3.1 The identifying function

The identifying function is carried out to *single out an object in space by indicating its place*. To do this mainly demonstratives are used, which vary on the deictic dimension of proximity (proximal–distant) to the speaker and on the non-deictic dimension of number (singular–plural). In English the following demonstratives are used for the different dimensions:

proximal-singular: 'this'
proximal-plural: 'these'
distant-singular: 'that'
distant-plural: 'those'

The entity that is referred to is called the *demonstratum*. The referring act may consist of two stages (see also section 3.1.3). First, the speaker directly refers to some place, which does not have to be the demonstratum. Second, in order to make the link between the demonstratum and the intended referent, a referring function has to be applied. For instance, in order to be able to refer to a crack in a vase, the speaker first points at the vase as a whole. Then, on the basis of mutual knowledge a referring function is applied to map the demonstratum onto a likely referent. If speaker and hearer mutually know that the vase has been there for ages, the referring expression will probably not be interpreted as 'Look at that vase'. The hearer then has to look for something salient or new in the vase, and will most probably notice the crack. Consequently he will assume that the crack is the intended referent.

4.3.2 The informing function

The informing function is carried out if the speaker wants to *inform the hearer about the place of an object*. This is typically done by deictic adverbials and prepositions, such as 'here', 'there', 'in front of', 'behind', 'left' and 'right'. For this to be done, a *relatum* plus a *coordinate system* are needed. The relatum is the entity with respect to which the referent object can be localized. The coordinate system orients the referent object with respect to the relatum. By varying the relatum and the origin of the coordinate system three possible informing references can be distinguished: *primary and secondary deictic reference* (which have already been mentioned in section 4.2), and *intrinsic reference*.

- **Primary deictic reference**

In an act of primary deictic reference the speaker is both the origin of the coordinate system and the relatum. Here a *coordination problem* may come forward, because in order to be able to identify the intended object the addressee must know where the speaker is located and what his orientation is. The speaker, on his part, must be aware of the addressee's ability to have access to such information. An example of primary deictic reference is ([Levelt 89]):

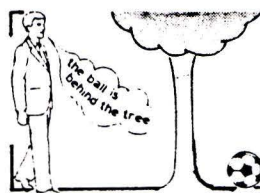
The ball is in front of me



- **Secondary deictic reference**

Here the speaker is the origin of the coordinate system and the relatum is some other object. An example is ([Levelt 89]):

The ball is behind the tree



This definition of secondary deixis solves the objections that were raised against the definitions of [Brown&Yule 83] (section 2.2.1) and [Fillmore 75] (section 4.2). Here secondary deictic reference can really be called deictic, because the speaker is still the origin of the coordinate system. This should be the case, because by means of a deictic expression a direct relation must be established between the speaker and the object referred to. Also, this definition contradicts the definition of primary deixis by Fillmore in the same section. He fails to distinguish between the speaker as relatum and some object as relatum, and calls both types of deixis primary deixis, while Levelt calls the second type secondary deixis.

- **Intrinsic reference**

Intrinsic reference is not deictic, because the relatum is the same as the origin of the coordinate system. This means that a particular object is located with respect to the intrinsic orientation of the relatum. In this case the position of the speaker is not relevant. Intrinsic reference can only take place if the relatum has an intrinsic orientation. For example a chair has a front, a back, a left and a right side, whereas a ball has none of these. An example is ([Levelt 89]):

The ball is in front of the chair



Note that [Rauh 83a] (section 2.4) calls this kind of reference non-egocentric deixis. The objection that was raised against that term there is successfully refuted here, because here the referring expression is not called deictic.

The choice of using either a deictic or an intrinsic strategy may be influenced by the speech situation in which the speaker is embedded. For instance [Ehrich 84] suggests that the deictic system is the most convenient one for describing complex spatial arrangements. According to her, the intrinsic system is less useful for tasks requiring verbal reasoning, but it is for instance suitable for indicating the relation between two fixed objects. Unfortunately, she gives no explanation for these preferences.

[Levelt 82] provides a detailed comparison of the deictic and the intrinsic way of referring. He does this by studying very carefully the different situations wherein the deictic expression pairs 'left'-'right', 'in front of'-'behind' and 'above'-'below' either can or can not be used. He found that the deictic system is the default system. It can always be used, provided that the

listener knows where the speaker is. For the use of intrinsic reference Levelt formulates the so-called *principle of canonical orientation*:

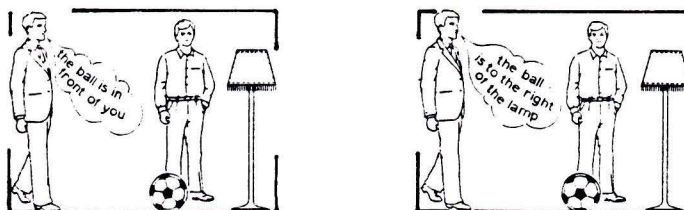
‘For the intrinsic system to refer to a reference object’s intrinsic dimension, that dimension must be in canonical position with respect to the perceptual frame of orientation (normally: the experienced vertical) of the located object.’

So, if an object is not in its canonical (perceived as normal) orientation, intrinsic reference can not be used. For instance, when a chair is pictured upside-down, it is hard to say ‘to the right of the chair’ in the intrinsic sense. However, the principle of canonical orientation is violated for the pair ‘above’-‘below’. Here intrinsic use is possible just in those cases where deictic use predicts the same usage of terms. This has to do with the fact that in the other cases at least one of the two objects does not occupy its normal canonical position, so that intrinsic use is not possible. So, if two chairs *A* and *B* are pictured one on top of the other, both in canonical positions, there is no difference between an intrinsic or a deictic strategy. In both cases the expression would be ‘*A* is above *B*’ or ‘*B* is below *A*’. If *B* does not occupy its normal canonical position, but is for instance pictured upside-down, the used expressions would be the same. However, in this case they can not be interpreted in the intrinsic sense.

Apart from primary and secondary deictic reference and intrinsic reference there are other ways to refer locally as well:

- **Geographic coordinate system**
In the place of the aforementioned coordinate system a geographic coordinate system can be used (i.e. ‘west’, ‘east’, ‘north’, ‘south’).
- **Speaker as basis coordinate system**
Instead of the speaker the addressee can be taken as the basis for the coordinate system. The relatum can be either the addressee or some object. For example:

1. *The ball is in front of you* 2. *The ball is to the right of the lamp*



In the first example the speaker states explicitly that he has designated the hearer as basis of the coordinate system ('in front of you'). In the second example he leaves this designation implicit. It is the task of the hearer to find out that the speaker actually meant 'to the right of the lamp from your view'. In general, hearers do not have problems making these kinds of inferences.

Note that [Brown&Yule 83] (section 2.2.1) and [Fillmore 75] (section 4.2) called this type of reference secondary deixis. Levelt is right not to call it deixis, because in these cases no direct relation is established between the speaker and the object referred to.

- **No coordinate system**

Local reference can also be accomplished without an implicit or explicit coordinate system (for example 'here', 'there', 'near'). However, there are some problems that have to be dealt with here. With respect to 'here' the so-called *delimitation problem* comes forward. This means that it is not obvious beforehand which area can be covered by 'here'. Using 'there' means that some specification of direction has to be added, either linguistically or by means of pointing. This suggests that still some vague kind of coordinate system is needed.

- **Deixis by analogy**

The last way to refer locally is by means of deixis by analogy, which [Rauh 83a] categorizes as one of the deictic uses in section 2.4. Here the place that is demonstrated by means of intrinsic or deictic reference is not the real place the speaker is meaning to refer to. This is for example the case in:

Arnold: 'Does John have scars after the accident?'

Betty: (touching her right cheek with her index finger)

'Yes, he got a big one here.'

In this example Betty uses her own face as an analogue for John's face. Deixis by analogy also happens when indicating a place somewhere on a map. Then the map serves as an analog for the 'real' spot somewhere on earth.

4.3.3 The acknowledging function

The acknowledging function of place deixis is used *when the location is not being referred to, but when it is rather presupposed*. So in the utterance the speaker acknowledges that the presupposition holds. This is for example the case in some uses of the deictic motion verbs 'come' and 'go'. 'Come' indicates that the goal of motion is a region around the deictic origin. 'Go' indicates that the goal of motion lies outside the speaker's region. For example when someone uses the utterance:

Christian is going to the library

the speaker himself is indicating that he is **not** in the library. If he actually was in the library he should have said:

Christian is coming to the library

4.4 Cross-cultural aspects of place deixis

The functions of place deixis that were treated in the previous section can be found in many languages. Whether this means that they are also universal functions is not clear by now. As [Weissenborn&Klein 82] state, there is a discrepancy between theoretical assumptions that are made with respect to place deixis and our actual knowledge of the form and function of deictic phenomena in natural languages. The authors assume that there is a direct relationship between features of the extra-linguistic environment in the context of a particular language and the specific structure of its deictic system. The way people conceive of their environment plus the objects present in their environment play an important role as well.

4.4.1 Location conception

Levinson lists many, as he calls them, distinctive kinds of *location conception* that have been found in several, mainly anthropologic, studies of the deictic systems in a number of non-European languages [Levinson 92]. He subdivides the kinds of location conception in three main groups, namely *relative angles*, *absolute angles* and *landmarks and placenames*.

- **Relative angles**

The group of relative angles consists of *deictic and anthropomorphic centering, projection onto objects and other persons* and *intrinsic reference*. Deictic and anthropomorphic reference are equivalent to Levelt's ([Levelt 89]) primary deixis (e.g. 'in front (of me)'), and projection onto objects and other persons corresponds to Levelt's secondary deixis (e.g. 'in front of the tree'). Both authors indicate the same concept by the term intrinsic reference. Levinson indicates that uses of primary as well as secondary deixis may vary between languages, because they have different projection systems. For example English speakers use a so-called *confronting projection* and Hausa² speakers an *aligned projection* ([Hill 82]). This means that whereas for Hausa speakers the field of the perceived objects is parallel to the derived (the speaker's) field, for English speakers both fields are facing one another. The effect is that while an English speaker says 'in front of the tree', the Hausa speaker would say in the same situation 'behind the tree'. So the Hausa speaker places himself, as it were, in the position of the tree, looking in the same direction as he actually is doing. Then, of course, the ball is located behind him. In the pictures the speaker's

²An Afro-Asiatic language.

field is represented by the left arrow and the perceived object's field by the right one.

With respect to intrinsic reference, Levinson discusses the variants of this type of reference in different languages. Particularly oriented facets of objects with an intrinsic orientation can be conceived on analogy to *anthropomorphic body parts* ('head', 'left'), *quadrupal body parts* ('horn', 'tail') or *house parts* ('ridge', 'pillar'). Facets may also be assigned on the basis of *shape* ('triangle'), the *canonical* ('head' of a fallen bottle) or *actual* ('top(side)') *orientation* of the object or the assumed *function* of the object ('teeth' of a knife).

- **Absolute angles**

The second group consists of *finite angular divisions* (e.g. 'north', 'south' or other systems), the so-called *n-independent axes* (e.g. inland or sea, uphill or downhill) and *n-points* (fixed points derived from for instance the position of the stars or the direction of some wind).

- **Landmarks and placenames**

The third group consists of the landmarks and placenames. These expressions may provide a *general description* or a *partonymic division* of objects or regions. In case of a partonymic division objects or regions are subdivided in parts that have certain names. For instance a certain region can serve as the ground with respect to which the figures can be located. In Tzeltal for example the shape of a region is often compared to the human body, so some location can be indicated by just saying for instance 'at the head of' followed by the name of the region. The difference between the use of this type of intrinsic reference in Tzeltal and the same kind of use in other languages (like 'de kop van Noord-Holland' ('the head of North-Holland') in Dutch) is that the use in Tzeltal is more common, and not idiomatized, like it is in Dutch.

4.4.2 Features of objects

Apart from the different kinds of conception of the environment there are also some features of the objects referred to that may be relevant for using the right deictic expression, and that vary between languages. The features that are mentioned most in the literature are the respective *staticity* or *dynamity* of the referent, the *visibility* of the referent and the *relative distance* of the referent with respect to the speaker and/or hearer ([Weissenborn&Klein 82]). In section 4.2 the influence of the staticity or dynamicity of an object on the deictic expression was already discussed. It is not clear whether this influence occurs in all languages or not.

In some non-European languages, like the Australian language Dyirbal and in Hausa, the visibility versus non-visibility of the referent has an impact on the use of referring expressions. For example, Hausa exhibits a shift from

the aligned projection strategy to the confronting strategy when an object is hidden, either partially or wholly, by another. The hidden object is then referred to as being behind the hiding object, whereas in the aligned system the hidden object would have been in front of the hiding object ([Hill 82]).

As far as we know, the possibility to distinguish between relative distances of referents with respect to the speaker and/or the hearer is present in all languages. In almost every deictic system it is at least possible to encode the *proximal–distal* distinction. This seems to be very obvious, but it does not mean that every usage of the appropriate proximal or distal term really refers to this distinction.

For example in Dutch generally ‘deze’ (‘this’) refers to a proximal object and ‘die’ (‘that’) to a distal one. In contrast, [Kirsner 79] notices that ‘deze’ can also be used to indicate attention and concern with the referent. This is for example the case in:

Toch betreft het hier een verhaal dat binnen het oeuvre van deze schrijver uitzonderlijke betekenis heeft.

(‘Yet here we are dealing with a story having exceptional significance within the literary work of this author.’)

Also, in casual language sometimes the referent is proximate, but ‘deze’ is not the right expression, like in the following example, where ‘die’ is used to indicate that the speaker and Frits are on friendly terms:

“Ha, die Frits!”, zei de jongen.

(“Aha, Frits!”, the boy said.)

These findings let Kirsner to choose for other parameters than proximate and distal, namely *high and low deixis*, which indicate the strong resp. weak force with which the user is urged to find the referent. High deixis is equivalent to the use of ‘deze’ and low deixis to the use of ‘die’. Speakers might apply three strategies to decide which form to use. The first strategy is *noteworthiness*. The speaker uses this strategy to direct attention strongest to entities that he is most interested in talking about. The second strategy is *givenness*. The speaker will direct the hearer’s attention strongest to entities that are not given in the hearer’s consciousness. The last strategy is *foregrounding*. Strong urging of the hearer to find the referent is combined with foregrounding of the noun in question and weak urging will be coupled with devices for backgrounding. Now high deixis (‘deze’) is associated with objects that are noteworthy, not given and foregrounded. Low deixis (‘die’) is associated with not noteworthy, given and backgrounded objects. In the case of the ‘Frits’-example above Kirsner probably considers Frits as already given in the hearer’s consciousness, which is true, because the hearer is Frits himself. However, the other two strategies, noteworthiness and foregrounding are not so clear in this case. Kirsner develops some criteria for deciding the outcome of the three strategies for every instance of ‘deze’ and ‘die’, but the question remains whether these are really the criteria people use for

deciding between the use of 'die' or 'deze'.

Another example of a study of the use of deictic terms to indicate relative distances is carried out by [Stechow 82] on German. German has three place deictic expressions, namely 'hier' ('here'), 'da' ('there') and 'dort' ('there'). 'Hier' is the only expression that can be used without having to indicate some direction in which the hearer has to look. By using 'hier' in this sense the speaker refers to the place of the utterance. However, 'hier' can also be used in a demonstrative way. Then it is often accompanied by a demonstration (e.g. pointing) and indicates a place relatively near the speaker. 'Dort' and 'da' can only be used demonstratively. In the case of 'dort' the demonstration can not point to a place which includes the speaker. 'Da' is relatively neutral, provided that the place can indeed be demonstrated.

4.5 Empirical studies of place deixis

There are two important areas wherein place deixis has been investigated by means of empirical studies, namely in *spatial descriptions* and in *route directions*. Some of these studies will be discussed below.

4.5.1 Spatial descriptions

[Linde&Labov 75] carried out a well-known study on spatial description. They asked subjects to give a description of the lay-out of their apartments. The results indicated that most subjects performed this task by making an *imaginary tour* around their apartment. They imagine themselves walking through their apartments and describing the furniture they encounter. This finding has an implication for the use of place deictic expressions. While making an imaginary tour through an apartment, the origo of the deictic expressions (the speaker) shifts position constantly, so the expressions change with it.

[Ullmer-Ehrich 82] replicated Linde and Labov's study, but instead of asking for apartment descriptions, she asked some students for a description of the room they were living in. She found that most of the subjects employed a so-called *gaze tour* for making the descriptions. This means that no origo shifts occurred, the entire room was described as it were while standing in one imaginary position, usually the entrance. Most subjects used a deictic perspective, but when describing a subregion of their room, e.g. the kitchen counter, changed into the intrinsic perspective. They marked the shift between the intrinsic and the deictic perspective by using a temporal deictic term instead of a place deictic one, e.g. 'and then'. In this way hardly any ambiguity between the deictic and the intrinsic perspective occurred.

[Levelt 82], in a study of spatial direction terms, also found that people may use either a deictic or an intrinsic orientation type while describing a network of nodes connected by lines. Furthermore, he found that people

use two different types of linearization strategies, *movers* and *jumpers*. The difference lies in the way they backtrack to choice points in the network. The jumpers select a branch, describe it entirely and then leap back to the choice point in order to describe another branch. The movers, on the other hand, do not leap back, but move back step by step along the branch that they just have described.

These three studies show that the strategies people use for describing spatial arrangements have an impact on the employment of (deictic or intrinsic) referential expressions.

4.5.2 Route directions

[Klein 82] studied local deixis in route directions. He found two specific features that are important with respect to deixis in this kind of direction, namely the set-up of the deictic space in the beginning of the conversation and the constant origo shift in the following part.

In the beginning of the conversation the hearer and the speaker do not share a deictic space. The speaker sets it up by indicating the fixed points along the route and, if necessary, by providing additional information. The fixed points can be brought up by the speaker on the basis of the previous knowledge the speaker thinks the hearer possesses about specific landmarks etc. (e.g. 'Do you know ...?'). If they are in the space of visual perception, the landmarks can be pointed at (e.g. 'Do you see ...?'). Also (non-deictic) descriptions of the fixed points can be given (e.g. '...a place with a fountain', '...where those people are sitting'). Finally, a frequently used strategy is to indicate fixed points relative to previous ones (e.g. 'the first ... after ...', 'the next ...'). In the beginning of the conversation the origo is the location of the speaker. But in the following part of the description, the imaginary location of both participants is constantly shifted during an imaginary walk: the route that is being described. So in this part both speaker and hearer must be aware of their imaginary position and direction of gaze during the imaginary walk, in order for the hearer to be able to make the right decisions when he is actually walking the real route (e.g. 'turn left' must be interpreted with the location and the orientation of the speaker in mind).

[Wunderlich&Reinelt 82] studied the verbal devices (in German) that are used in route directions. They found that nominals are mainly used to indicate the point of orientation (the *fixed points* in [Klein 82]). The most important verbal group are the so-called *directives*, that direct the questioner's attention (e.g. 'hier' ('here'), 'immer' ('always'), 'bis' ('until'), 'direkt' ('directly')). Further, a lot of *position markers* are used, like 'rechts' ('right'), 'rauf' ('upon'), 'vorne' ('in front of'). The last verbal group consists of the *verbs of movement*, like 'gehen' ('walk'), 'fahren' ('drive'), 'kommen' ('come') etc. These verbs are optional, they do not have to be used in order for the route direction to be understandable. Wunderlich and Reinelt conclude that near the beginning and near the final destination only a very

small and limited class of words can be used, particularly 'hier' and 'direkt'. In the space in between the words and constructions that were mentioned above may be applied. However, although these results may be interesting for German, it is not clear whether they add new insights to the theory on place deixis in general.

The studies on route directions show that it is possible to communicate very complicated concepts, composed of fixed points, directions, position markers, and verbs of movement, by means of so-called 'Deixis am Phantasma'. Note that most of the deictic expressions that are used in these directions refer to objects that are represented in the mind of the speaker, and which he should try to transfer to the mind of the hearer. So it is not a coincidence that many people consider supplying route directions to be such a difficult task.

Chapter 5

Gestures in human-human and in human-computer interaction

5.1 Introduction

Gestures play an important role in the use of deictic expressions. Many place deictic terms can not be interpreted if the speaker does not indicate by means of pointing or nodding which object he is referring to. Because pointing is a potential mode of communication between humans and computers, it is worth while to examine the characteristics of gestures that are produced by humans while speaking. The results of such a study might be useful for designing a graphical interface that offers the user the opportunity to combine natural language expressions with pointing while communicating with a system (e.g. the DenK-system).

In section 5.2 the types of gestures that occur during human-human communication are discussed. Also the interplay between gestures and speech is treated there. In section 5.3 research on the use of gestures in human-machine communication is discussed.

5.2 Gestures in human-human interaction

5.2.1 Introduction

Until now a great deal of research on gestures in general has been carried out. Particularly the *American Sign Language* (ASL), that is employed by the deaf, has been studied in depth. For instance [Bellugi&Klima 82] have studied deictic and anaphoric reference in ASL. Unfortunately, the interaction of speech and gestures, especially deictic (pointing) gestures, has not been studied very well. However, in order to be able to distinguish between different types of gestures, and particularly to pick out the deictic gestures, we first need to know more about gestures during speech in general.

5.2.2 Types of gestures during speech

Traditionally the gestures that people make during speech are subdivided into two categories: *emblems* and *illustrators* ([Ekman&Friezen 72]).

Emblematic gestures are employed instead of complete utterances, and are accordingly independent of the accompanying speech. They can be called gestural stereotypes and have social codes of their own, independent of speech. Examples of emblems are a waving hand instead of the expression 'good-bye' or displaying the 'okay'-sign instead of uttering the word. The meaning of emblems, just like the meaning of facial expressions, is often cultural specific. For instance [Calbris 83] found that in many cases foreigners were not able to interpret facial expressions or gestures of French people that were demonstrated to them in a movie. When the same movie was shown to French people they had hardly any problems interpreting the signs.

Illustrators are speech-dependent gestures. They are spontaneous, semi-conscious gestures whose meaning is dependent on the accompanying speech, so it is difficult to interpret them without the speech. They play pictorial and discourse-related roles, which means that they can not be interpreted without knowing to what text, object or picture they are related. Illustrators can occur as three different types: *iconix*, *metaphorix* and *beats* ([McNeill&Levy 82]). Iconic and metaphoric gestures supplement the propositional content of linguistic units, in contrast to beats, that have no propositional content of their own.

Iconix exhibit in form and manner of execution (e.g. forceful, slow) a meaning relevant to the simultaneously expressed linguistic meaning. McNeill and Levy found in the video-taped monologues they studied an example of an iconic gesture in a fragment where the speaker said: 'he crawls up the pipe' while at the same time his hand moved upward.

Metaphorix, as well as iconix, exhibit a meaning relevant to the concurrent linguistic meaning. However, the relation to the linguistic meaning is indirect. In form and manner of execution, metaphoric gestures depict the vehicles of metaphors. An example of a metaphor is, according to McNeill and Levy, 'choosing is weighing' (used in 'on the other hand' and in 'weigh the alternatives'). When in one of the video-fragments a speaker said: 'trying to figure out what to do', simultaneously both his hands formed cups, alternating up and down. This metaphoric gesture seemed to involve the hands hefting two objects, symbolizing two possibilities that can be carried out.

Both metaphorix and iconix contribute to the vividness of speech. They can also add information to the contents of the speech, e.g. they can make clear what the exact shape of a described movement is or what the exact size of an object is. Also, as was pointed out by [Krauss&Morrel-Samuels 88], gestures help speakers by facilitating the lexical process. This means that gesturing while searching for a word or expression reduces the time needed to find it.

Beats are abstract visual indicators, that are particularly appropriate for emphasizing discourse-oriented functions, where the importance of a linguistic item arises from its relation to other linguistic items. For example a beat can accompany a linguistic repair, like in ([McNeill 85]): 'Alice li-Alice lives with her father who's a new uh runs a . . . sort of a newsstand' accompanied by a rising and coming down of the fingers at the moment of the beginning of the repair. The form of the gesture does not really matter in the case of beats, because no symbolic meaning can be attached to it.

Iconix as well as metaphorix are referential gestures; they refer to an entity (concrete or abstract) that is introduced in the language. Deictic gestures are much like iconix (or metaphorix) with the extra requirement that they are often obligatory. Without these accompanying gestures a deictic utterance can not be understood. Another important feature of deictic gestures is that they not only exhibit a semantic parallel with the accompanying linguistic unit, but also together with this unit refer to some extra-linguistic entity. Beats can occur accompanying discourse deictic terms, since discourse deixis is a device for structuring discourse and referring to underlying speech acts. Exactly at those points in a discourse, where relations to other linguistic units are established, beats may occur too.

5.2.3 Cognitive aspects

[McNeill 85], [McNeill 87] as well as [Levelt&Richardson&La Heij 85] argue that contrary to what is often thought (e.g. [Feyereisen 85]), gestures and speech are part of the same psychological structure and share a computational stage in the language production process. Evidence provided by McNeill includes the observation that 90% of the gestures only occur during actual speech production. This means that there are hardly any gestures during pauses in speech. Further, gestures and speech exhibit parallel semantic and pragmatic functions. For iconix, there is a clear semantic parallel between the gestures and the linguistic units. For metaphorix, there is a semantic parallel to the abstract meaning of sentences. Beats can exhibit pragmatic functions in discourse, like indicating that a linguistic repair is being carried out.

Also, gestures synchronize with the parallel linguistic units. Gestures and linguistic units that are semantically parallel occur at the same time. Further evidence for a shared computational stage, also provided by McNeill, include the finding that gestures are affected like speech in aphasia and that gestures develop parallel to speech during the development of language in children.

Levelt, Richardson and La Heij give a more detailed analysis of the parallelism between gestures and speech at word level. They carried out an experiment where subjects had to indicate a certain light in an array of referent lights through pointing and/or using a deictic expression ('this' or 'that'). By means of an analysis of the moments of gesture initiation and apex (the climax of the gesture), and relating these to the time of speech onset, the interaction between speech and gesture could be measured very

precisely. They found, for deictic expressions, that both systems indeed do interact during the planning phase, but that they are independent during motor execution. These results serve as support for the *ballistic view*, which implies that motor systems for gesture and speech interact during the planning phase, but are modular during motor execution. At sentence and discourse level not much is known of the assumed parallelism between gestures and speech. In an experimental study on the conceptual representations in language activity and gestures [McNeill&Levy 82] found that there are clear parallelisms between levels of language organization and the use of gestures. In their experiment subjects had to tell a story to another subject, but were encouraged to point at pictures of the main characters. During the narrations, the subjects only used iconix to support narrative events that formed the main story line. These gestures were very structured and had a strong correlation with the meaning of the event. Beats only occurred as extra-narrative comments, so they did not contribute to the main story line. Metaphorix occurred in a narrative as well as in an extra-narrative context.

5.3 Gestures in human-computer interaction

5.3.1 Keyboard input and spoken input

In human-machine interaction the traditional mode of input is the keyboard. Recently input by means of other devices, like the mouse, has been introduced. Even more recently speech input has developed into being a new and promising mode. However, technically there are still a lot of drawbacks with respect to speech input, which will not be considered here further. In this report it is sufficient to state that for the time being it is not possible to fully replace keyboard input by speech input. This is regrettable, because a combination of speech input and pointing with the mouse in human-machine interaction would be a nice 'translation' of a natural way of communication between humans, which is speech accompanied by gestures ([MacAogáin&Reilly 90]). Humans have acquired an enormous skill in these modes of communication. If they were allowed to apply this skill in communicating with a system this would expectedly enhance the efficiency of the interaction ([Hayes ??]). Of course, for the time being, the speech input could be replaced by keyboard input. An obvious disadvantage of this replacement is the fact that it is not possible to type in a message and to point with the mouse at the same time. However, [MacAogáin&Reilly 90] show that a solution for this dilemma exists. They show that it is possible to first park the mouse at an item on the screen to select it, and next to communicate via the keyboard about this item. Another disadvantage of the application of keyboard input instead of speech input is that there might be differences in language use between the two modes. For instance, [Cohen 84] found in an experiment where subjects had to identify objects during an assembly task that in spoken interaction people made explicit requests to the hearer to identify objects, while in keyboard interaction these kinds of requests did not occur. Despite of the disadvantages of using keyboard input

it seems to be worth while investigating how language and pointing combine in human-computer interaction.

5.3.2 Advantages of using gestures

Beside the fact that speech accompanied by gestures is a natural way for humans to communicate, gestures also have some inherent qualities that contribute to the ease of communication.

[Morrel-Samuels 90] studied the possibility of using *gestural commands* instead of verbal commands. Gestural commands are substitutes for verbal commands or function key commands as they are provided by the system. An example of a gestural command is putting a cross on top of a word on the screen instead of using the 'delete word'-command to remove it. The advantages of gestural commands included the observations that they are terse, common and relatively unambiguous. In section 5.2.2 it was already suggested that gestures help speakers by facilitating lexical access ([Krauss&Morrel-Samuels 88]). This might indicate that gestural interfaces will facilitate cognitive processing and accordingly improve the interaction. Morrel-Samuels distinguishes illustrative and emblematic gestural commands¹. *Illustrative gestural commands* (e.g. circles, brackets and braces) resemble gestures in speech. *Emblematic gestural commands*, which are iconic, (e.g. using 'X' for deleting an item) establish a non-arbitrary relationship between the shape of the gestural command and its meaning. These icons are probably easier to remember than their linguistic counterparts, because iconicity enhances recall. In summary Morrel-Samuels concludes that gestural commands are easier to use, faster, more memorable and more likeable than verbal commands. Possible applications could be the drawing of 'X'-s as answers in multiple-choice tests or the use of standardized proof reader's marks in systems for the print media. However, some doubts with respect to the possibility of generalizing these findings over different domains remain. Using the same gestures in other domains than the ones discussed by Morrel-Samuels may give rise to different meanings or may not be very appropriate in that particular context.

5.3.3 Integrating gestures and language

The design of a graphical interface with the possibility of verbal as well as gestural modes of input poses some fundamental problems. The used language has to be anchored to the graphical or linguistic material on the screen by means of pointing actions together with deictic expressions ([Lee 91]). During this referring process ambiguities might easily arise; sometimes it is difficult to identify which entity was actually pointed to.

[Hayes ??] notices two more problems. In the first place it is not always obvious whether a pointing event is meant as a natural language pointing event or not. This means that sometimes a mouse is not used to refer to an

¹Compare to the *illustrators* and *emblems* in the preceding chapter.

object, but e.g. to pull down a menu (see also [MacAogáin&Reilly 90]). Secondly, the system has to determine where the entities pointed at fit within the overall interpretation of the natural language input. Hayes offers some potential solutions for the problems that have been isolated so far. If natural language pointing events are made identifiably different from others the problem of separating these two events is solved. One could also assume that all pointing events that occur during natural language input are natural language pointing events. Further, the position of the pointing device must be determined when a deictic phrase is used in order to make the link between the deictic expression and the object that is being pointed to.

Hayes states that it is in particular important to coordinate natural language anaphora and pointing to objects on the screen, because here each of the two modes forms an essential part of the meaning of the whole expression. However, Hayes does not mention that most of these cases in fact do not concern anaphoric expressions, but deictic expressions. Anaphoric expressions do not need an accompanying pointing gesture, they can always be solved by checking the previous dialogue context. Deictic expressions, on the other hand, in many cases need accompanying pointing gestures so that the system is able to identify the object referred to.

Hayes also mentions that in order to be able to identify a referent it is necessary to know which entity is in focus. Anaphoric expressions can be linked to their antecedents by using a representation of the previous discourse in which the possible antecedents that are in focus occupy certain places. Then anaphora can only refer to one of the entities that sit in these places. In the domain of conversation on the screen the dialogue focus can for instance be indicated by highlighting the appropriate objects. This indication of the focus can then be used to determine the referent of succeeding deictic expressions.

Natural language reference together with pointing can not always ensure that the right entity is chosen by the system. If there is a doubt, the system can ask for clarification. After all this is how ambiguities are solved in human-human communication as well.

Chapter 6

Conclusions and future research

6.1 Conclusive summary

The present literature report shows that a lot of fundamental theoretical research has been carried out on reference in general and deixis in particular, mainly in the field of linguistics. Unfortunately this means that also a lot of confusion exists considering terminology and definitions. In this report a try has been given to sort out this confusion and to select and discuss the most important aspects of deixis. Special attention has been devoted to the gestural aspect of deictic referring acts. Further, some applications of knowledge about deixis in human-computer interaction have been explored.

Definitions of deixis agree on the fact that it concerns all referring expressions that can not be interpreted without considering the (real or imaginary) extra-linguistic situation of the utterance. The speaker, the location of the speaker and the time of the utterance together form the origin of this situation. By means of a deictic expression a relation is established between the origin and the entity that is being referred to. Different types of deixis (person, social, place and time deixis) can be distinguished by considering the entities that they refer to. Several less obvious types of deixis are modal, topical, relevance and emotional deixis. Uses of deixis are distinguished by considering the different situations in which the deictic terms can be applied. The uses include: *Demonstratio ad oculos*, *Deixis am Phantasma*, *Deixis im Vorstellungsraum*, analogous deixis, and non-egocentric deixis.

Discourse deixis can be considered either a type or a use of deixis. The problem is that it does not deal with extra-linguistic reference, but with reference to linguistic items in the preceding discourse with respect to the momentary position of the speaker in the discourse. These items are either contents of utterances or underlying speech acts. Anaphora can be considered a subcategory of deixis, because they also perform a referring function, except that they do not refer to extra-linguistic entities, but to linguistic ones. So anaphora can be seen as a subcategory of deictic expressions, and deictic expressions, on their turn, can be seen as a subcategory of referring

expressions in general.

The process of referring to entities is not a task of the speaker alone. It is a collaborative process performed by both interlocutors. One of the interlocutors (*A*) starts by uttering a certain expression, while taking into consideration the knowledge he supposes the other (*B*) possesses. *B* tries to interpret the expression, and indicates whether he was able to do this or not. If not, *B* might try to guess what the missing information could be. *A* then confirms *B*'s (motivated) guesses or provides additional information. This process may take several turns until both interlocutors agree that they have the same entity in mind.

Place deixis, the type of deixis that is described most extensively in this report, can serve three functions, namely the identifying, the informing and the acknowledging function. These functions, each one in a different way, make clear where some entity is located. An important problem of place deixis is that there are many different ways to make reference to a particular location, so that it is essential to know which strategy the speaker is using in order to be able to interpret the expression correctly. Also, the means by which people refer to places differs across different linguistic and cultural communities.

Place deictic expressions are often accompanied by gestures. In order to make clear the location of some object a mere linguistic expression is seldom enough, so a pointing gesture has to be added to indicate the right gaze direction for the hearer. Beside pointing gestures people make many other gestures during speech, so it is important to be able to distinguish between deictic and non-deictic gestures.

Despite the large amount of theoretical knowledge about place deixis, not much is known about the ways people actually *use* these expressions and how they combine them with gestures. Until now only some empirical research on referring expressions in route directions and in spatial descriptions has been carried out. For instance, within the DenK-project it would be interesting to examine the ways in which users of a graphical interface refer to objects that are represented on a computer screen, both linguistically and by means of a pointing device. This is one of the areas to which future research can be directed, and which will be worked out below.

6.2 Future research

The theoretical knowledge about reference and deixis in human-human dialogues can be used for designing experimental research on how deixis is applied in human-computer interaction. So-called *Wizard of Oz*-experiments can be designed, where the user is led to believe that he is communicating with a 'real' computer system, whereas in reality a human operator is acting as a conversation partner.¹ This type of experimental set-up can be used to examine how people tend to refer to objects that are represented (in 2- or 3-D) on a computer screen. A condition in which people are allowed to

¹See for an overview of such experiments [Dahlbäck&Jönsson 88].

point with a mouse and another in which they may only communicate by means of the keyboard can be compared. Also the ways in which language and pointing are combined in one single reference act can be studied. A comparison with referring behaviour in human-human interaction may be interesting, because much more is already known about this subject, and this knowledge could be transferred to human-computer applications. For instance, previous research has pointed out that referring is a collaborative process of both dialogue partners. In this process they take into account the knowledge they assume the partner possesses. The partners also take into account the focus of the discourse at the moment of the utterance. It is interesting to study this process of collaborative reference during human-computer interaction.

In the past, in theories of discourse representation, a lot of knowledge has been gathered on the way anaphora refer in discourse. Knowledge about how people refer deictically to extra-linguistic objects is not present to such a great extent. In human-computer interaction the domain of discourse is rather limited, roughly the language and graphics that are represented on the screen. A detailed and controlled study of how the deictic referring process works here, may provide important insights in the way perception is linked to language. In this framework knowledge about which object features people use to distinguish them from other surrounding objects can also be acquired.

A side-effect of this type of research is that a representation must be developed of the referring acts themselves (including language and gestures), the knowledge that is used to decide which expression to use and the process of collaborative reference. Such a representation should make clear for every instance of a referring expression what entity is being referred to, by making use of assumed previous knowledge of the dialogue partners and the contents of the referring act itself.

Bibliography

- [Ahn&Beun 91] R. Ahn & R.J. Beun. *Voortgangsverslag integratieproject DenK: augustus 1990-januari 1991*. Eindhoven, Instituut voor Perceptie Onderzoek, Rapport no. 785, 1991.
- [Auer 84] J.C.P. Auer. *Referential problems in conversation*. *Journal of Pragmatics* 8, 627-648, 1984.
- [Bellugi&Klima 82] U. Bellugi & E.S. Klima. *From gesture to sign: deixis in a visual-gestural language*. In: R.J. Jarvella & W. Klein (eds.). *Speech, place and action: studies in deixis and related topics*. Chichester, John Wiley & Sons, 297-313, 1982.
- [Brown&Yule 83] G. Brown & G. Yule. *Discourse analysis*. Cambridge, Cambridge University Press, 1983.
- [Bühler 82] K. Bühler. *The deictic field of language and deictic words*. In: R.J. Jarvella & W. Klein (eds.). *Speech, place and action: studies in deixis and related topics*. Chichester, John Wiley & Sons, 9-30, 1982. (English translation by the editors of Bühler's most important ideas, originally published in German in 1934.)
- [Calbris 83] G. Calbris. *Contribution à une analyse sémiologique de la mimique faciale et gestuelle française dans ses rapports avec la communication verbale*. Paris, Sorbonne, 1983. (Review article: D. Bouchet. *Communication and cultural specificity: the importance of gestures and face expressions*. *Journal of Pragmatics* 13, 111-117, 1989.)
- [Clark 77] H.H. Clark. *Bridging*. In: P.N. Johnson-Laird & P.C. Wason (eds.). *Thinking: readings in cognitive science*. Cambridge, Cambridge University Press, 1977.
- [Clark&Marshall 81] H.H. Clark & C.R. Marshall. *Definite reference and mutual knowledge*. In: A.K. Joshi, B.L. Webber & I.A. Sag. *Elements of discourse understanding*. Cambridge, Cambridge University Press, 1981.
- [Clark&Wilkes-Gibbs 86] H.H. Clark & D. Wilkes-Gibbs. *Referring as a collaborative process*. *Cognition* 22, 1-39, 1986.

- [Cohen 84] P.R. Cohen. *The pragmatics of referring and the modality of communication*. Computational Linguistics 10(2), 97-125, 1984.
- [Dahlbäck&Jönsson 88] N. Dahlbäck & A. Jönsson. *The Wizard of Oz in computer science: simulations of natural language interfaces*. Linköping, Universitetet och tekniska högskolan, Institutionen för datavetenskap, NLPLAB Memo 88-01, 1988.
- [Deemter 91] K. van Deemter. *On the composition of meaning: four variations on the theme of compositionality in natural language processing*. Dissertation Amsterdam, 1991.
- [Dialogvoering 89] *Dialogvoering en kennisopbouw: programma 1989-1997*. Tilburg/Eindhoven, Samenwerkingsorgaan Brabantse Universiteiten, 1989.
- [Ehlich 82] K. Ehlich. *Anaphora and deixis: same, similar or different?*. In: R.J. Jarvella & W. Klein (eds.). *Speech, place and action: studies in deixis and related topics*. Chichester, John Wiley & Sons, 315-338, 1982.
- [Ehlich 83] K. Ehlich. *Deixis und Anapher*. In: G. Rauh (ed.). *Essays on deixis*. Tübingen, Narr, 79-98, 1983.
- [Ehrich 84] V. Ehrich. *Zur Linguistik un Psycholinguistik der sekundären Raumdeixis*. In: H. Schweizer (ed.). *Sprache und Raum*. Stuttgart, Metzeler, 1984.
- [Ekman&Friesen 72] P. Ekman & W. Friesen. *Hand movements*. Journal of Communication 22, 353-374, 1972.
- [Feyereisen 85] P. Feyereisen. *Gestures and speech, interactions and separations: a reply to McNeill (1985)*. Psychological Review 94(4), 493-498, 1987.
- [Fillmore 75] C.J. Fillmore. *Santa Cruz lectures on deixis 1971*. Bloomington, Indiana University Linguistics Club, 1975.
- [Fillmore 82] C.J. Fillmore. *Towards a descriptive framework of spatial deixis*. In: R.J. Jarvella & W. Klein (eds.). *Speech, place and action: studies in deixis and related topics*. Chichester, John Wiley & Sons, 31-59, 1982.
- [Goodman 86] B.A. Goodman. *Reference identification and reference identification failures*. Computational Linguistics 12(4), 273-305, 1986.
- [Hawkins 84] J.A. Hawkins. *A note on referent identifiability and co-presence*. Journal of Pragmatics 8, 649-659, 1984.
- [Hayes ??] P.J. Hayes. *Steps towards integrating natural language an graphical interaction for knowledge-based systems. ??*

- [Hill 82] C. Hill. *Up/down, front/back, left/right: a contrastive study of Hausa and English*. In: J. Weissenborn & W. Klein (eds.). *Here and there: cross-linguistic studies on deixis and demonstration*. (Pragmatics and beyond: an interdisciplinary series of language studies III, 2/3). Amsterdam/Philadelphia, John Benjamins Publ. Co., 13-42, 1982.
- [Kaplan 77] D. Kaplan. *Demonstratives: an essay on the semantics, logic, metaphysics, and epistemology of demonstratives and other indexicals*. Paper presented for Symposium on Demonstratives at a meeting of the Pacific Division of the American Philosophical Association, 1977.
- [Kirsner 79] R.S. Kirsner. *Deixis in discourse: an explanatory quantitative study of the modern Dutch demonstrative adjectives*. In: T. Givón (ed.). *Discourse and syntax*. (Syntax and semantics 12). London, Academic Press, 1979.
- [Klein 82] W. Klein. *Local deixis in route directions*. In: R.J. Jarvella & W. Klein (eds.). *Speech, place and action: studies in deixis and related topics*. Chichester, John Wiley & Sons, 161-182, 1982.
- [Kobsa et al. 86] A. Kobsa, J. Allgayer, C. Reddig, N. Reithinger, D. Schmauks, K. Harbusch & W. Wahlster. *Combining deictic gestures and natural language for referent identification*. In: *Proceedings International Conference on Computational Linguistics (CoLing)*. Bonn, 1986, 356-361.
- [Krauss&Morrel-Samuels 88] R. Krauss & P. Morrel-Samuels. *Some things we do and don't know about hand gestures*. Paper presented at the meeting of the American Association for the Advancement of Science, Boston, 1988.
- [Kryk 87] B. Kryk. *On deixis in English and Polish: the role of demonstrative pronouns*. (Bamberger Beiträge zur Englischen Sprachwissenschaft, Band 21). Frankfurt, Peter Lang, 1987.
- [Lee 91] J. Lee. *Graphics and natural language in multi-modal dialogues*. Second Venaco Workshop on the Structure of Multi-modal Dialogue, preproceedings. Italy, Maratea, 1991.
- [Levelt 82] W.J.M. Levelt. *Cognitive styles in the use of spatial direction terms*. In: R.J. Jarvella & W. Klein (eds.). *Speech, place and action: studies in deixis and related topics*. Chichester, John Wiley & Sons, 254-268, 1982.
- [Levelt 83] W.J.M. Levelt. *Some perceptual limitations on talking about space*. In: A.J. van Doorn, A.J. van de Grind & J.J. Koenderink (eds.). *Limits in perception: essays in honour of Maarten A. Bouwman*. Utrecht, VNU Science Press, 323-358, 1983.

- [Levelt 89] W.J.M. Levelt. *Speaking: from intention to articulation*. Cambridge/London, The MIT Press, 1989.
- [Levelt&Richardson&La Heij 85] W.J.M. Levelt, G. Richardson & W. La Heij. *Pointing and voicing in deictic expressions*. *Journal of Memory and Language* 24, 133-164, 1985.
- [Levinson 83] S.C. Levinson. *Pragmatics*. Cambridge, Cambridge University Press, 1983.
- [Levinson 92] S.C. Levinson. *Primer for the field investigation of spatial description and conception*. *Pragmatics* 2(1), 5-47, 1992.
- [Linde&Labov 75] C. Linde & W. Labov. *Spatial networks as a site for the study of language and thought*. *Language* 51, 924-939, 1975.
- [Lyons 77] J. Lyons. *Semantics*. (Volume 2). London, Cambridge University Press, 1977.
- [Lyons 82] J. Lyons. *Deixis and subjectivity: 'loquor, ergo sum?'*. In: R.J. Jarvella & W. Klein (eds.). *Speech, place and action: studies in deixis and related topics*. Chichester, John Wiley & Sons, 101-124, 1982.
- [MacAogáin&Reilly 90] E. MacAogáin & R. Reilly. *Discourse theory and interface design: the case of pointing with the mouse*. *International Journal of Man-Machine Studies* 32, 591-602, 1990.
- [McNeill 85] D. McNeill. *So you think gestures are non-verbal?* *Psychological Review* 92(3), 350-371, 1985.
- [McNeill 87] D. McNeill. *So you do think gestures are non-verbal! Reply to Feyereisen (1987)*. *Psychological Review* 94(4), 499-504, 1987.
- [McNeill&Levy 82] D. McNeill & E. Levy. *Conceptual representations in language activity and gesture*. In: R.J. Jarvella & W. Klein (eds.). *Speech, place and action: studies in deixis and related topics*. Chichester, John Wiley & Sons, 271-295, 1982.
- [Miller 82] G.A. Miller. *Some problems in the theory of demonstrative reference*. In: R.J. Jarvella & W. Klein (eds.). *Speech, place and action: studies in deixis and related topics*. Chichester, John Wiley & Sons, 61-72, 1982.
- [Miller&Johnson-Laird 76] G.A. Miller & P.N. Johnson-Laird. *Language and perception*. Cambridge, Cambridge University Press, 1976.
- [Morrel-Samuels 90] P. Morrel-Samuels. *Clarifying the distinction between lexical and gestural commands*. *International Journal of Man-Machine Studies* 32, 581-590, 1990.

- [Pechmann 84] Th. Pechmann. *Überspezifizierung und Betonung in referentieller Kommunikation*. Dissertatie Mannheim, 1984.
- [Quine 71] W.V. Quine. *The inscrutability of reference*. In: D.D. Steinberg & L.A. Jakobovits (eds.). *Semantics: an interdisciplinary reader in philosophy, linguistics and psychology*. Cambridge, Cambridge University Press, 1971.
- [Rauh 83a] G. Rauh. *Aspects of deixis*. In: G. Rauh (ed.). *Essays on deixis*. Tübingen, Narr, 9-60, 1983.
- [Rommetveit 68] R. Rommetveit. *Words, meanings and messages*. New York, Academic Press, 1968.
- [Schegloff&Jefferson&Sacks 77] E.A. Schegloff, G. Jefferson & H. Sacks. *The preference for self-correction in the organization of repair in conversation*. *Language* 53, 361-382, 1977.
- [Schmid 72] W.P. Schmid. *Die pragmatische Komponente in der Grammatik*. In: G. Rauh (ed.). *Essays on deixis*. Tübingen, Narr, 61-78, 1983. (Reprint from: *Akademie der Wissenschaften und der Literatur* 9, 1-20 (407-424) and 61-78, 1972.)
- [Stechow 82] A. von Stechow. *Three local deictics*. In: R.J. Jarvella & W. Klein (eds.). *Speech, place and action: studies in deixis and related topics*. Chichester, John Wiley & Sons, 73-99, 1982.
- [Ullmer-Ehrich 82] V. Ullmer-Ehrich. *The structure of living space descriptions*. In: R.J. Jarvella & W. Klein (eds.). *Speech, place and action: studies in deixis and related topics*. Chichester, John Wiley & Sons, 219-249, 1982.
- [Weissenborn&Klein 82] J. Weissenborn & W. Klein. *Introduction*. In: J. Weissenborn & W. Klein (eds.). *Here and there: cross-linguistic studies on deixis and demonstration*. Amsterdam/Philadelphia, John Benjamin, 1-12, 1982.
- [Wunderlich&Reinelt 82] D. Wunderlich & R. Reinelt. *How to get there from here*. In: R.J. Jarvella & W. Klein (eds.). *Speech, place and action: studies in deixis and related topics*. Chichester, John Wiley & Sons, 183-201, 1982.