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Adverbs in the transfer module of MDS

Mariana Damova

Universität Stuttgart

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Mariana Damova

Institut für Maschinelle Sprachverarbeitung
Universität Stuttgart
Azenbergstraße 12
D – 70174 Stuttgart

Tel.: (0711) 121 - 1363
Fax: (0711) 121 - 1366
e-mail: mariana@ims.uni-stuttgart.de

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Abstract

This manuscript describes the treatment of adverbs in the transfer module of the MDS version of VerbMobil[1]. The following problems are discussed in it: 1) necessity, methodology, and results of the contrastive linguistic analysis pursued, 2) amount of the data, 3) connection between the semantic construction module and the transfer module, 4) transfer rules for adverbs, 5) English semantic lexicon, 6) analysis of the achieved, problems and improvements suggestions

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Contents

1 Introduction

1.1 Sketch of the Task

The task of the treatment of adverbs in the transfer module of the MDS version of VerbMobil was divided into four parts:

1. to find translation equivalents in English of each adverb from the German word list issued by the University of Bielefeld.

2. to determine their readings, and to introduce appropriate (one or more) semantic predicate names (PredNames) into the English Lexicon[2].

3. to formulate conditions for disambiguation[3] :
   a) by means of occurrence of PredNames restrictions
   b) by means of semantic sortal restrictions.

4. to produce transfer rules for each lexical entry

The scenario of VerbMobil considers the particular domain of appointment scheduling. This set constraints on the exhaustiveness of the possible word meanings of each single adverb. Readings, relevant for the context of VerbMobil, which we determined on the basis of studies of the evidence from the test suite of dialogues, were handled with priority, and the rest of "non relevant" readings for the scenario of VerbMobil was not really considered.

We followed a strategy of choice of PredNames after two principles:

1. PredNames as close as possible to English lexemes – keep in mind the lexical choice in the Generation module

2. as few PredNames as possible – avoid need of disambiguation by introducing equally ambiguous English items[4]

For example, the lexeme *eigentlich* can be translated into English with: *actually, really, as a matter of fact, in reality, exactly, strictly speaking, originally, frankly.* We only introduced the PredName *actually*, which is a good candidate for PredName, as the rest of the lexicalizations and respectively of the readings can be associated with it. Thus, only one transfer rule was produced, translating *eigentlich* into *actually.*

Contrastive analyses were pursued to determine the English translation equivalents, and the readings of the German lexemes in order to produce well matching

[2]In cases of ambiguous lexemes when a suitable unique candidate for a PredName (i.e. showing complete semantic equivalence between the German and the English lexeme within one PredName) was not available, more than one English PredName was introduced.

[3]The cited in a) and b) below means were the two technically available mechanisms for disambiguation provided by Semantic Construction, (cf. the section on Semantic Construction). The Transfer module obeyed the uniform output of the Semantic Construction module, which provided some technical constraints on the representation of ambiguities, and on the possible ways to disambiguate. Furthermore, the strict determination of disambiguation conditions was not always possible, because of lack of enough appropriate studies of most of the semantic classes of adverbs in VerbMobil to provide a well elaborated theoretical framework, and the constraints issued from the short time limits of MDS.

[4]We avoided introducing more English PredNames by choosing the most suitable one for all possible readings of the German lexeme, i.e. the one which showed parallel ambiguities.

German–English PredNames. The results of some of the analyses did not actually influence the Semantic Construction module of the MDS, but provided a set of descriptive studies and an outline of problems which are to be taken into consideration for the future development of the system.

1.2 Data – Sources and Size

The contrastive analysis of adverbs for VerbMobil we pursued was based on consulting three sources of data: 1) Word list with suggested translations of CSLI, based on the German word list of Bielefeld, 2) corpus of German dialogues of the test-suite for VerbMobil translated into English, 3) corpus of German non-translated dialogues of the test-suite for VerbMobil. For theoretical consistency we also looked at bilingual English-German dictionaries, and relevant literature. Most of the results however are issued directly from the empirical studies of the dialogues.

The word list of Bielefeld contains 215 adverbs, distributed in several semantic classes within the semantic construction module. Not all adverbs of the word list occur in the test-suite of Dialogues for the demonstrator. They will be itemised in the appropriate subsections.

1.3 Connection of Transfer Module with other Modules in MDS

The transfer is realized at level of PredNames[5] , where the TAU rule uses the information of two semantic lexicons: a German one and an English one. The German semantic lexicon provides the relation between the German lexeme and the semantic information associated with it: (a) PredNames, and (b) semantic type of the adverb ex.(1a), whereas the English semantic lexicon contains the relation between the PredNames, their arguments, and the semantic type of the adverb ex.(1b).

(1) a. `lex(LEXEME) => SUBCLASS_adv_sem(PredName).`

b. `sem_lex(PredName,#Args) => SUBCLASS_adv_sem1(PredName,#Args).`

There are German lexemes of the word list of VM, which were given several semantic subclasses, because of their various semantic properties. Thus, the number of the lexical entries in the semantic lexicon increased. For example, *noch* was initially classified as a temporal adverb for uses as in: "*Im July bin ich* NOCH *im Urlaub.*", and as a focus adverb for uses as in: "*Wir machen* NOCH *einen Termin aus.*". Also, *eher* was classified as a comparative of the adverb *bald* for uses as in: "*Peter kommt eher als Suzan*", and as an intensifier for uses as in: "*Peter ist eher klug.*". Thus, some lexemes occur more than once in the German semantic lexicon of VerbMobil. The number of the lexical entries in the semantic lexicon increased. It happens even that one lexeme gets classified in semantic subclasses normally assigned to distinct word classes. For example, *echt* was classified as an adjective, as a modal adverb, and as an intensifier, *etwas* was classified as an indefinite pronoun, and as an intensifier, *offensichtlich* was classified as an adjective, and as a standard adverb (see sem_lex2.stuf).

[5]For detailed argumentation on the transfer strategy see [MD94].

2 Contrastive Analysis of Adverbs

This subsection outlines informal[6] results of the contrastive analyses of adverbs we pursued, without implementing them in the version of MDS. We summarise into classes the problematic cases to handle in the Transfer module so far, and discuss some phenomena causing transfer difficulties.

2.1 Lexicalization

- Mismatch in the lexical meaning of the source and the target adverb – mapping of meanings
  Some lexical translations of German adverbs in English do not correspond to their lexical meanings. The lexical choice in these cases depends on the contextual conditions, corresponding to the scenario of VerbMobil. For example, the relevant translation equivalent for the adverb *höchstens* in the context of VerbMobil is *only possibly* ex.(2), whereas in a standard German-English Dictionary, such as [PT91] this reading is translated as *not more than, at the most, except.*

  (2) HOMN038 :
  wir könnten's HÖCHSTENS so machen, am 7ten und am 14te
  We could ONLY POSSIBLY *do it so that it is on the seventh and the fourteenth.*

  Similar phenomenon can be observed with the adverb *noch.* One of the translation equivalents for its "additive reading" in the dialogues of VerbMobil is *also* ex.(3), whereas in a standard German-English Dictionary [PT91], this reading is translated into *one more*

  (3) HOMN009:
  dann war NOCH vorgesehen ein Abteilungsleitertreffen, ne?
  Then a meeting of department heads had ALSO *been planned, right?*

  These two examples of focus adverbs show that the lexicalization of their meanings depends on the lexical context in which they occur.

- Mismatch in the lexical type of the source and the target adverb

  Some English translation equivalents of German adverbs are discontinuous morphemes[7] or composed adverbial phrases ex.(4a-e). This is due to the complex lexical meaning of the German adverbs, which is decomposable into smaller semantic units. The cited adverbs in ex.(4a-e) contain an anaphoric element, and a further semantic element. Thus, a semantic representation approach similar to the one pursued by the analysis of pronoun adverbs will be very suitable to treat this type of German adverbs.

  (4) a. deswegen → that is why
  b. infolgedessen → as a result

[6] "Informal" here is used as "non formalised"

[7] Thanks to Arthur Merin for this term. It corresponds to the German *Mehrwortlexeme*

c. trotzdem → for all that
d. vorhin → a little while ago
e. vorerst → for the time being

The adverbs in ex.(5a-b) are also semantically complex, but the semantic units in which they are decomposable cannot be set as clearly as by the examples in ex.(4a-e). So, it is not obvious how to approach for their semantic representation.

(5) a. dennoch → but still
b. kurzfristig → at short term

However, the English word complexes in ex.(4a-e) and in ex.(5a-b) are not well represented by one single semantic predicate (PredName) as the transfer strategy of MDS was designed. In such cases a lexical decomposition of the German items (still on the German side of the system) will provide the relevant representations for a consistent transfer into English.

- Translation into null_lexeme

Some German particles, classified in the group of adverbs, are regularly omitted in the English translations of the dialogues of VerbMobil, as shown in ex.(6a-b).

(6) a. denn → ε

MPS1_1_01:
Wann wär's Ihnen DENN recht?
When would suit you?

b. ja → ε

MMS4_1_05:
Da Sie JA wissen, daß ich mittags noch einen Termin hab', bei Dani
You know that I've got an appointment with Dani at lunchtime.

The fact that they are not literally translated into English does not mean that these particles are meaningless. These types of particles are not considered as constituents of the syntactic structure of the sentences they occur in. But, it is difficult to determine whether their informative value is a semantic one or a stylistic one and also whether it applies to the single expressions, they occur in, or to the entire discourses these single expressions occur in. For example, *doch* in ex.(7) does not appear lexicalized in the English translation. Nevertheless, it is obvious that this German particle is not rôleless in the cited expression. The same is true for the particles in the sentences of ex.(6a-b).

(7) mps1_1_01:
Ja, prima, dann lassen Sie uns DOCH noch einen Termin ausmachen.
Yes, fine, then let's just arrange an appointment.

2.1.1 Meaning

- Context dependent translations

  Lexically ambiguous German adverbs trigger context dependent translations. Thus, only an account for the course of the conversation will help disambiguating the German *also* in the following two occurrences (ex.(8a-b)) – "*also* of the new topic coming" in ex.(8a)[8], and "*also* consecutive" in ex.(8b)[9].

(8) a. *also* → *well*

HI:1:FBS1_1_02:
ALSO ich dachte, noch in der nächsten Woche –
WELL*, I was thinking of next week already* –

b. *also* → *so*

HI:6:MMS5_1_09:
ALSO könnten wir etwa ab halb 5 uns treffen
SO *we could meet after half past four*

- Scope ambiguities

  Some adverbs show scope ambiguities, which influence the translation into English. The type of the biggest semantic entity which falls into the scope of such adverbs seems to help disambiguating them. Thus, the sentences in ex.(9a-c) will trigger distinct semantic representations each, because the adverb *überhaupt* has scope over different semantic entities in them: 1) over negation in ex.(9a), 2) over a question operator in ex.(9b), 3) over a whole expression in ex.(9c). Relevant semantic representations of these three cases will be very useful for optimating the task of the transfer module in this case. Furthermore, the English translations of *überhaupt* in sentences ex.(9a-c) are distinct, and they seem to depend on the scope of *überhaupt*, as shown in ex.(9a-c).

(9) a. *überhaupt* with scope over negation → *at all*

MFD1_2_02:
schönen guten Tag Herr Schaaf. leider paßt es mir am 9ten ÜBERHAUPT nicht weil ich vom 9ten bis zum 11ten außer Hause bin.

b. *überhaupt* with scope over question → *at all*

MMS1_3_10:
zu welchem Termin innerhalb der nächsten 2 Wochen hätten Sie denn ÜBERHAUPT Zeit?

[8] The same readings of the German *also* was independently discussed in [SF95]. There it was referred to as the discourse function "uptake".
[9] Thanks to Michael Schiehlen for this term.

c. *überhaupt* with scope over an entire expression → generally

KAE008:
und wir müssen ÜBERHAUPT noch einen Besprechungstermin im Oktober ausmachen.

- Pragmatics in the translation of adverbs

The adverb *vielleicht* in ex.(10a-c) is translated into *maybe* ex.(10a), *perhaps* ex.(10b), and *possibly* ex.(10c).

(10) a. MPS1_1_11:
Gut, wollen wir's dann gleich am Montag den 3ten Mai machen VIELLEICHT um halb 4.
Good, do we want to do it rightaway on Monday the 3rd of May then, MAYBE *at three thirty.*

b. MPS1_3_10:
ich habe von 9 bis 12 Uhr auch noch eine Vorlesung. wenn wir es VIELLEICHT danach probieren wollen?
I have another lecture from nine to twelve too. what if we PERHAPS *try it afterwards?*

c. MHM1_1_12:
Können wir VIELLEICHT das auf den Vormittag legen
Could we POSSIBLY *schedule that for the morning.*

This fact raises the question whether it is a lexicalisation problem to be solved by the Generation module, or it is a phenomenon with semantic effects, which should be taken into consideration within the Transfer module. German native speakers' intuitions argue that *vielleicht* conveys an unambiguous interpretation, and the three English translation equivalents were just different lexicalizations of one and the same meaning. Thus, one transfer rule would be sufficient to provide the information relevant for the Generation module. Whereas English native speakers' intuitions[10] argue that distinct "things" are conveyed by the expressions in which one of each English lexical equivalent of *vielleicht* occurs. So, provided information about these distinctions in the Transfer module will be useful to guide the lexical choice of the Generation module. One hypothesis for the interpretation of this phenomenon is that the mode of the dialogue expression[11] gives the relevant conditions for selecting one of the three English translation candidates.

A salient transfer in such cases depends on the dialogue act of the expression in which it occurs, and the general pragmatic context of the conversation pursued. Such information was not really available in the MDS version of Verbmobil.

[10] I do thank Prof.Mats Rooth for consenting this distinctions.

[11] We consider that a "dialogue mode" can be figured out from the combination between the type of the dialogue act of the current expression (for example: *make_a_date_proposal*, vs. *preference_for_a_proposed_date* to distinguish between *maybe* and *perhaps*) and the information about the common knowledge conveyed by the two participants of the conversation (for example: in order to distinguish between *subjective_possibility*, and *objective_possibility* of the appointment scheduling after the circumstances accounted for to select *possibly*).

- Semantic complexes formed by adverbs and other word classes

  Some German adverbs syntactically combine with other word classes, and form one semantic complex. Intuitively, the adverbs seem to get particular readings, only in particular syntactic environment. Example (11a) illustrates a semantic effect triggered by the combination between the adverb *so* and the preposition *um*, in which the adverb plays a role of a "preposition modifier", approximating or weakening the meaning of the preposition. Thus, the semantic complex *so um* they form, is translated into the English *around*. Another semantic effect triggered by the syntactic cooccurrence of an adverb and a word of a different word class can be observed in example (11b) too. The adverb *noch* forms a semantic complex with the indefinite pronoun *(et)was*, in which the individual referred to by the pronoun implies the interpretation of *noch* in its "additive reading". Thus, the meaning of the entire semantic complex *noch etwas* can be expressed with *one more (additional) thing*, which justifies the lexicalization of the English translation into *something else*.

(11) a. *so um* → *around*

FBS1_1_04:
Aber Donnerstag vormittag SO UM 9 wär mir recht.
But Thursday morning AROUND *9:00 would be fine with me.*

b. *noch etwas* → *something else*

HAH005:
da müssen wir uns ja NOCH WAS anderes überlegen.
we'll have to think of SOMETHING ELSE *then.*

It is transparent that such complexes can be accounted for compositionally, but there are still mechanisms needed to distinguish them in the texts, and to supply correct syntactic and semantic structures.

Thinking in semantic terms the modifier *so* can be defined and represented as applying to a semantic entity referring to a temporal location, and *noch* - to an individual to give the discussed semantic effects.

2.1.2 Style

The scenario of VerbMobil - processing of spoken dialogues - is endowed with numerous translation idiosyncrasies of German into English due to stylistic reflections of pragmatic factors, which cannot be easily explained in interpreting lexical items, syntactic structures, and building semantic representations.

- Transfer of style

  The English lexicalization of some German modifiers are not semantically defendable. For example the English *a bit* in ex.(12) is the equivalent of the German *eigentlich*. Except for the lack of lexical semantic nearness between these two lexical items, the semantic and syntactic structures of the two sentences in ex.(12) differ. *Eigentlich* has a wide scope over the whole German expression, whereas *a bit* clearly connects to the temporal location item - *too late.*

(12) eigentlich → a bit (*in the context of the Scenario* of VerbMobil);
eigentlich → actually (*lexical meaning from a Dictionary* [PT91])

HI:1:FBS1_1_12:
halb 4 ist mir EIGENTLICH zu spät
Half past three is A BIT *too late for me*

Although the lexical choices should primarily be of concern for the Generation module, considering transfer of pragmatic information to facilitate the determination of the salient stylistic registers of the English inputs will only improve the quality of the coming from the system translations.

Another example illustrating the need of stylistic information in the boundary between transfer and generation is ex.(13), in which the approximating temporal location expression *"ab 14 Uhr"so* reflects into the English *let's say some time.* This lexicalization cannot simply be transfered even after a perfect syntactic, semantic, and lexical analysis and representation of the German item FBS1_1_10.

(13) FBS1_1_10:
In der 1ten Maiwoche ist noch jeder Nachmittag frei in meinem Terminkalender SO AB 14 Uhr.
I'm still free each afternoon of the first week in May. LET 'S SAY *some time* AFTER *two o'clock.*

- Accumulation of particles

  Syntactic accumulation of particles is a typical phenomenon for German. In some cases the accumulated particles form one semantic entity and can be represented through one PredName. Some of the particles in such complexes seem to dominate semantically over the other accumulated particles (compare example (11a) with example (14a).

(14) a. da mal so → around
b. das ist noch nicht mal so schlecht → that is not that bad
c. ja schon immer mal → anyway

2.2 Conclusion

It is obvious that to produce a satisfiable semantic representation for adverbs, which will account for the context of the VerbMobil scenario of spoken dialogues it is necessary to conserve a sufficiently abstract apparatus of semantic features. It should be powerful enough in expressiveness to: 1) cope with the mismatches in the translations, talked about, without loss of information, 2) transfer the semantic and stylistic content and leave open the final decision for lexicalization to the Generation module.

Adverbs in VerbMobil are divided into subclasses after their semantic content and their compositional properties. We adopted the subclassification of adverbs provided by the Semantic Construction module of VerbMobil[12]:

modal adverbs, focus adverbs, temporal adverbs, pronoun adverbs, intensifiers, interrogative adverbs, negative adverbs, standard adverbs, discourse relations

3 Modal Adverbs

This section describes the treatment of modal adverbs in the Transfer module of MDS. When we talk about *modalities*, as this term occurs in the name of the class of *modal adverbs*, we have to distinguish between: 1) the notion of *modality* in the logic, where the possibility, probability or necessity in linguistic expressions are interpreted with respect to the truth conditions of these expressions, and 2) the notion of *modality* in the language, where it is defined as a mixed morpho–syntactic and semantico–pragmatic caterogy referring to the relation between the speaker and his predication on one hand and the relation between the predication and the reality on another hand[13]. *Modal adverbs* in VerbMobil are designed after the notion of *modality* in the language.

3.1 Modal Adverbs in the Semantic Construction Module of MDS

Modal adverbs are handled uniformly as sentence adverbs by the Semantic Construction module of MDS. They appear at the end of the structure of the analysed sentences, introduce a Dimension Condition, a nd refer to the event described by the sentence. The concept of modality is defined as VALUE of the feature DIMENSION (ex.(15)).

(15) Er kommt EIGENTLICH.

$$\begin{bmatrix} DRS \\ \begin{bmatrix} kommen: [1] \\ \begin{bmatrix} dimen\_condition \\ dimen\_inst: [1] \\ dimen\_pred: eigentlich \\ dimension: modality \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

3.2 Size of the Data

Modal adverbs in the word list issued by the University of Bielefeld (see sem_lex2.stuf) count 32:

echt, natürlich, ganz, notfalls, komplett, prinzipiell, glattweg, schätzungsweise, rundweg, schlimmstenfalls, völlig, sicher, vollends, sicherlich, ziemlich, sowieso, allerdings, strenggenommen, bestimmt, unwahrscheinlich, eigentlich, vielleicht, eventuell, wahrscheinlich, fast, womöglich, gegebenenfalls, zirka, herum, zur_not, möglicherweise,

[12] Motivation for this classification can be found in [McG94, MD94, Ebe95]

[13] We adopted the definitions of *modality* given by Lexandowski in Linguistisches Wörterbuch [Lex94].

zweifellos

Eight of them occur in the test suite of dialogues for MDS[14]:

echt, eigentlich, sowieso, allerdings, vielleicht, komplett, fast, natürlich

3.3 Classes of Modal Adverbs

This subsection outlines informal results of the semantic analysis of modal adverbs we pursued, without implementing them in the version of MDS. We provided a finer classification of modal adverbs which seems to be consistent with the semantic information conveyed by them on one hand, and to fit the strategy to represent semantic information in VerbMobil on another hand.

The classes of modal adverbs were identified after two general criteria:

- structural properties – account for the semantic entities they can apply to
- nature of the modification – account for the semantic effect of the modifier applied

For example, the modal adverbs accounted for show types of modalities with the following structural properties:

- sentence internal modalities. These modalities belong to one sentence. They are to be classified as event modifiers[15].
- sentence external modalities. These modalities belong to different sentences, i.e. they denote relations between two DRS-es.

Two groups of modal adverbs were distinguished.

- on the basis of their structural properties
  - the first group can refer to smaller semantic entities – events, modifiers etc.
  - the second group can refer to a whole DRS
- on the basis of the type of their semantic contribution
  - the first group is neutral to the information in the previous discourse (context independent)
  - the second group introduces semantic nuances which can only be accounted for in connection with the previous discourse

We illustrate the first group with the example of the modal adverb *komplett*, and the second group on example of the modal adverb *allerdings*.

[14] They were investigated in greater detail, than the rest of the word list.

[15] Some types of modifiers and their representation with attention to a Dialogue understanding system are discussed in [Ebe95]

3.4 Komplett

Komplett is representative of the group of modal adverbs which introduce a modality relevant for the event described by a single sentence. Thus, they are expected to appear in the DRS as event modifiers (ex.(16)).

(16) Montag können wir KOMPLETT vergessen.

$$\begin{bmatrix} DRS \\ \begin{bmatrix} \text{können: } [1] \\ \begin{bmatrix} DRS \\ \begin{bmatrix} vergessen: \ [2] \\ \begin{bmatrix} dimen\_condition \\ dimen\_inst: \ [2] \\ dimen\_pred: \ komplett \\ dimension: \ modality \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Modal adverbs of this group do not relate to eventualities described in the preceding discourse, (or the events described in the previous discourse). Compare example (17a) and example (17b). The presence of the adverb *komplett* in sentence RFD:DE017, example (17a), and the absence of the adverb *komplett* in sentence RFD:DE017, example (17b), shows that this adverb does not seem to be related to the interpretation of the discourse relations in the whole discourse, as it does not semantically contribute to the coherence of the discourse, but just to the interpretation of the event described by sentence RFD:DE017.

(17) a. RFD:EL016:*I can't make it at the beginning; I'm on vacation then.*
RFD:DE017: ach, da können wir den Oktober ja KOMPLETT VERGESSEN, aber nicht den November.
RFD:VM018: *oh, so we can* TOTALLY FORGET *about October, but not November.*

$$\boxed{\begin{array}{c} \text{x y e} \\ \text{x = wir} \\ \text{y = Oktober} \\ \text{e: vergessen(x,y)} \\ \text{komplett(e)} \end{array}}$$

b. RFD:EL016: *I can't make it at the beginning; I'm on vacation then.*
RFD:DE017: ach, da können wir den Oktober ja VERGESSEN, aber nicht den November.
RFD:VM018: *oh, so we can* FORGET *about October, but not November.*

$$\boxed{\begin{array}{c} \text{x y e} \\ \text{x = wir} \\ \text{y = Oktober} \\ \text{e: vergessen(x,y)} \end{array}}$$

Another property of this class of modal adverbs is that they do not only apply to events, but also to other types of modifiers (Mod), and to DRS–operators (DRSop), as it is shown in ex.(18) and ex.(19a-c). So, they are intersective.

(18) MFD1_4_04: das paßt wunderbar. der 16te ist bei mir KOMPLETT FREI (Mod). ich würde sagen wir treffen uns dann um 9 Uhr. Ort entscheiden Sie bitte.

(19) a. Er hat seinen Termin FAST VERGESSEN (E).
b. Er ist FAST FERTIG (Mod).
c. Er ist FAST IMMER (DRSop) zu spät.

Other modal adverbs belonging to the group of *komplett* are: *fast, echt, prinzipiell.*

3.5 Allerdings

First, the modal adverb *allerdings* does not always apply to the event described by the sentence, as it normally modifies its finite VP. For example, modal verbs in general do not describe an event, but introduce a modal condition, and as the sentences in ex.(20), and ex.(21) show *allerdings* applies to the modal verb *können* and not to the described event by the verb *machen* and *kommen.*

(20) ALLERDINGS können wir das Treffen montags machen.

$$\begin{bmatrix} \mathit{DRS} \\ \begin{bmatrix} \text{können: } [1] \\ \begin{bmatrix} \mathit{dimen\_condition} \\ \mathit{dimen\_inst}: [1] \\ \mathit{dimen\_pred}: \mathit{allerdings} \\ \mathit{dimension}: \mathit{modality} \end{bmatrix} \begin{bmatrix} \mathit{DRS} \\ \begin{bmatrix} \mathit{machen}: [2] \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

(21) ALLERDINGS wollte er montags kommen.

Second, *allerdings* introduces a semantic nuance which semantically relates to the information conveyed by the previous sentence.

(22) MPS1_1_19:
Ist bei mir etwa schlecht. ALLERDINGS könnte ich um 11 noch einen Termin reinschieben.

We interpret the semantic role of *allerdings* in example (22) in the following way. It is not only a sentence adverb, which refers to a Dimension *Modality.* Its semantic interpretation is connected with the information of the previous discourse. A rhetoric relation of *contrast* with the previous sentence, similar to the relation introduced by the conjunction *aber* is conveyed by the sentence containing *allerdings.*

Other modal adverbs belonging to the group of *allerdings* are: *vielleicht, eigentlich.* They also relate to two DRS-s, but they convey other types of rhetoric relations between them.

The reported semantic classes of modal adverbs were not implemented because of the uniform output of the Semantic Construction.

3.6 Future Work

It is necessary to determine and represent by means of distinguishing marks the modal adverbs in the semantic lexicon on example of the analysis of *komplett* and *allerdings*: 1) what kind of modalities can be expressed by the modal adverbs; 2) what semantic entities can be modified or bound by means of modal adverbs; 3) what are the semantic effects of different types of Modalities, which can be introduced by modal adverbs.

3.7 Determination of Readings and PredNames

We use the adverb *allerdings* to illustrate how the determination of an English PredName took place. *Allerdings* is ambiguous between two readings: 1) contrastive; 2) confirmative. Their English translation equivalents stay for them in ex.(23a-b).

(23) a. allerdings → but
b. allerdings → indeed

The reading in ex.(23b) does not occur in the test suite of dialogues for the Demonstrator, but in the entire corpus of dialogues for VM. The further examples show that other lexicalizations for the readings of *allerdings* in English are possible.

(24) *allerdings* into *but*

MPS1_1_03:
Ja,am Dienstag, den 6ten April hätte ich noch einen Termin frei ALLERDINGS nur nachmittags.
Yes, I would have time on Tuesday April 6th – BUT *only in the afternoon.*

(25) *allerdings* into *however*

BN:1:FLHN037:
am 28sten ALLERDINGS nicht
On the twenty-eighth HOWEVER *not*

(26) *allerdings* into *unfortunately*

HI:2:FSP2_1_06:
Da ging es bei mir ALLERDINGS nur am Freitag
UNFORTUNATELY *I am only free on Friday that week It would only be possible on Friday, however*

Example (24) lexicalizes *allerdings* into *but*, example (25) lexicalizes *allerdings* into *however*, example (26) lexicalizes *allerdings* into *unfortunately*. All these lexicalizations were summarized into PredName *but* ex.(27), as they all convey a relation of *contrast* with the previous sentence.

(27) allerdings → but2

Example (28) illustrates the second reading of *allerdings* - the confirmative one. The semantic effect of this adverb is transfered not literally, but through a phrasal change. Its emphasizing effect is lexicalized in English through the focal stress of the redundant *do* in the expression *I do already have.*

(28) *allerdings* into *phrasal change and focal stress*

BN:1:HOMN038:
21sten hab ich ALLERDINGS auch einen sehr langen Termin
on the twenty-first I DO *also already have a very long appointment.*

A plausible hypothesis for the process of disambiguation between the two readings of *allerdings* the contrastive and the confirmative one is that prosodic information will be helpful, as an accent on this adverb triggers almost always its *confirmative* reading.

3.8 Transfer PredNames of Modal Adverbs in MDS

The strategy adopted in the Transfer module of the MDS was to provide Target PredNames, which are as near as possible to the corresponding English lexemes. We list here informally the German PredNames with their English equivalents (see table 1 and tau_adv.stuf).

The shape of the transfer rule for modal adverbs is given in ex.(29) below.

(29)
```
tau_lex(SourcePredName,TargetPredName,[tau(#Mod, #Args)],
#Args,mod([#Mod])) => sem_t.
```

4 Focus Adverbs

This section describes the treatment of focus adverbs in the Transfer module of MDS. We understand under *focus adverbs* the semantic subclass referred to in the literature as *focus particles* [Kön91] or *focus sensitive particles* [Bos95]. After Johan Bos these particles do not introduce a focus themselves, but they have the property to apply to constituents, which are focused and prosodically stressed. The focus sensitive particles introduce presuppositions, which depend on the constituents in focus that appear in their scope. Furthermore, Bos claims that "the focus particles do not add anything to the meaning of the sentence, but rather "judge" whether the sentence in which they appear is acceptable in a given context or not." König on the other hand observes that focus particles in German and in English do have a lexical meaning, and outlines general parameters that play a role in their semantic analysis. The parameters are: 1) the scope of the focus particles, 2) alternatives – focus particles set restrictions on the selection of alternatives, in the framework of conception of focus as a relation between the value of a focused expression and a set of alternatives 3) scales – focus particles set selection restrictions for alternatives ordered with respect to the focus value in a certain way, 4) evaluation – focus particles set selection restrictions inducing an order for the value of the focus and the alternatives under consideration also express an evaluation. He also emphasises that the contribution made by a particle to the meaning of a sentence depends on the meaning of two components of that sentence: (a) on that of its focus and (b) on that of its scope. It seems that the structural account considered by Bos, and the meaning account considered by König in combination will give an optimal framework to deal with focus adverbs.

SourcePred	→	TargetPred
echt1	→	null_pred
echt1	→	really1
ganz2	→	quite
komplett	→	totally
glattweg	→	absolutely1
rundweg	→	flatly
voellig	→	entirely
vollends	→	wholly
ziemlich	→	quite
allerdings	→	but2
bestimmt	→	certainly
eigentlich	→	actually
eventuell	→	maybe
fast	→	almost1
gegebenenfalls	→	if_necessary
herum	→	around1
moeglicherweise	→	if_possible
natuerlich	→	of_course
notfalls	→	if_necessary
prinzipiell	→	basically
schaetzungsweise	→	roughly
schlimmstenfalls	→	at_worst
sicher	→	certainly
sicherlich	→	surely
sowieso	→	anyway
strenggenommen	→	strictly_speaking1
unwahrscheinlich	→	probably_not
vielleicht	→	maybe
vielleicht	→	perhaps
vielleicht	→	possibly
wahrscheinlich	→	probably
womoeglich	→	possibly
zirka	→	approximately
zur_not	→	if_necessary
zweifellos	→	undoubtedly

Table 1: Translation equivalents of PredNames of Modal Adverbs.

ADVERB	PredName	FocusOp
auch	auch	alternative
denn	denn1	##
erst	erst	temp
gerade	gerade	event
höchstens	höchstens	grad
noch	noch	temp;event

Table 2: Translation equivalents of PredNames of focus adverbs.

The semantic representation of focus adverbs in MDS is discussed in the following section.

4.1 Semantic Construction of Focus Adverbs in MDS

Focus adverbs were defined in the semantic construction of MDS as sentence adverbs with scope over the whole sentence. They introduce a *phi_condition* into the semantic structure (see ex.(30)), and their scope is designed to be always over constituents describing *states* or *events* (see phi_arg in ex.(30)).

(30) Er kommt AUCH.

$$\begin{bmatrix} DRS \\ \begin{bmatrix} DRS\_t \\ phi\_condition \\ phi\_arg => & \begin{bmatrix} kommen: & [1] \\ & \end{bmatrix} \\ phi\_op : alternative \\ phi\_pred : auch \end{bmatrix} \end{bmatrix}$$

Each focus adverb is assigned a semantic type referring to the presupposition it conveys. A feature FOCUSOP (focus operator) is introduced into the semantic lexicon to make this explicit. Thus, the form of the lexical entry for focus adverbs in the semantic lexicon consists of a lexeme, a semantic subclass, a PredName and a FocusOp (see ex.(31)):

(31) `lex(LEXEME) => focus_adv_sem(Pred,FocusOp)`

The attributed values of FocusOp in the Semantic Construction of MDS are: *alternative, temp, event, grad* (see table 2). They reflect the pursued analysis of the possible semantic effects triggered by focus adverbs[16].

[16]As the purpose of the present paper is to report about the actual realizations in MDS, we will not comment here further on the transparent possibilities to extent the semantic classification of focus adverbs, and on ways to interpret the defined FocusOp. As *auch*, *ausserdem* and *ausnahmsweise* were given the same FocusOp value: *alternative*, but the character of the "things" referred to by these alternatives is not intuitively one and the same.

4.2 Size of the Data

Focus adverbs in the word list issued by the University of Bielefeld (see sem_lex2.stuf) count 33:

alternativ auch ausserdem doch denn dann erst gerade grade gleich höchstens insofern ja mal mindestens noch nochmal nur schon selbst sogar sonst wenigstens wieder wiederum wohl zumindest ausnahmsweise überhaupt ausschliesslich frühestens spätestens später

Sixteen of them occur in the Test suite of Dialogues for MDS:

dann noch auch ja doch denn nur schon nochmal sonst gleich gerade erst wieder ausnahmsweise mal

4.3 Scope Ambiguities and Heuristics by Processing of Focus Adverbs

Focus adverbs were designed in the Semantic Construction module of MDS as particles which can have scope over *states* or *events*. The examples in ex.(32),ex.(33), show however that this is not always true. *Noch* has scope over the negation in ex.(32), and over the individual *Termin* in ex.(33). Furthermore, examples (32) and (33) illustrate two more readings of the adverb, which were not accounted for in MDS: ex.(32) corresponding to the English *yet*, and ex.(33) - to the English *another*. *Noch* with scope over negation is translated into *not yet*, and with scope over the individual – into *another*.

(32) HI:5:MOC1_1_18:
Das kann ich NOCH nicht sagen.

(33) MHK:1_1_02:
aber wir brauchen NOCH einen Termin.

The two sentences in ex.(32) and ex.(33) conform different semantic representations, than the uniform one for focus adverbs given in ex.(31). The disambiguation conditions in these two cases are to be found in the type of semantic entity which falls in the scope of the adverb *noch*. In fact if a structurally suitable output of the Semantic Construction will be provided, part of the disambiguation process will take place at that level, and consequently this will make possible the correct transfer of these two occurrences of *noch*.

Moreover, *noch* shows further ambiguities, depending on the prosodically stressed constituent of the sentence, as shown in ex.(34a-c). The sentence in ex.(34a) describes a situation which presupposes an enumeration of events (reading: *among other events*), the sentence in ex.(34b) describes a situation which presupposes an enumeration of individuals (reading: *one more x*), the sentence in ex.(34c) describes a situation which presupposes a final element of a finite enumeration of individuals (reading: *only one more x*).

(34) a. aber wir brauchen **NOCH** einen Termin
b. aber wir brauchen *noch* einen **TERMIN**

c. aber wir brauchen *noch* **EINEN** Termin

These three examples would trigger different representations. Information helpful for deciding what semantic structure is relevant can be provided by the output of the prosodic profile of the expressions (see ex.(35a-b)).[17]

(35) a. *noch* with scope over individuals → *one more x*

DATEN/N002K/NPS1K002.CPR:
sollen wir gleich im März NOCH **EINEN ANDERN** Termin ausmachen oder wann paßt 's Ihnen am besten

b. *noch* with scope over a described event → *among other events*

DATEN/N019K/NHK1K002.APR:
offensichtlich am Telefon aber wir brauchen NOCH einen **TERMIN** soweit ich weiß

Thus, the scope of *noch*[18] and the semantic properties of the entity which is in its scope, are of great importance to determine its reading. A process of semantic evaluation resulting in a structured semantic representation which accounts for the scope of the adverb will provide conditions to decrease the need of disambiguation in the Transfer module. A consideration of the prosodic profile of the expressions in the process of semantic evaluation will furnish necessary information with this respect.

4.4 Future work

It is still necessary to decide how to distinguish formally between the different readings of one adverb and then how it is possible to represent them without losing valuable semantic information. Means for structural representation of the scope, incorporation of prosodic information, and clearly elaborated account for the semantics of the *focus operators* will be of importance to achieve an efficient future development of the system VerbMobil.

4.5 Determination of Readings and PredNames

The lexically ambiguous adverb *höchstens* will be the example for the strategy adopted in the Transfer module of MDS to chose equally ambiguous English equivalents of the German PredNames to be the transfer PredNames.

The translations of *höchstens*, and respectively their readings, in [PT91] are: 1) *not more than* (nicht länger als; nicht mehr); 2) *at the most, at best* (bestenfalls); 3) *except* (ausser). *Höchstens* is translated in the Test suite of VerbMobil with the words: *only*, *only possibly*, *possibly* (see ex.(36),(37)). These lexical equivalents correspond to the second reading quoted in [PT91] : *at the most, at best*. The other two readings do not occur in the context of VerbMobil.

[17] The analysis and the interpretation of the readings of *noch* depending on the prosodic information were discussed with and approved by Jorg Meier.

[18] We used this adverb to show some phenomena proper for focus adverbs in general.

(36) *höchstens → only possibly*

HOMN038:
mm, den 28sten kann ich auch nicht, da bin ich in Berlin, 21sten hab ich allerdings auch einen sehr langen Termin, da seh ich schwarz, daß ich den verschieben kann. wir könnten's HÖCHSTENS so machen, am 7ten und am 14te
Mm, I can't make the twenty-eighth either, I'll be in Berlin then, on the twenty-first I do also already have a very long appointment, I don't think I can reschedule that. We could ONLY POSSIBLY *do it so that it is on the seventh and the fourteenth.*

(37) *höchstens → only*

HOMN044:
den 6ten bin ich leider auch außer Haus, da wär, seh ich auch keine Möglichkeit, das zu verschieben. es wär HÖCHSTENS dann 13te, ja , da könnt ich vormittags, und,
eh, I'll be out of town on the sixteenth as well, there is, I don't see a rescheduling possibility there either. There would ONLY *be the thirteenth, yes, I am free in the morning*

A problem was to decide how to represent this reading in PredNames in order to provide enough information to the Generation that the lexical meaning *at the most* is to be lexicalized into *possibly*, *only* in that particular contexts.

Two possibilities to cope with this problem exist:

1. to write one TAU rule which would transfer the predicate *höchstens* into the predicate *only_possibly*.
2. to find the reason why it is possible from lexical meaning *at the most* to get the lexicalization *only possibly*, and to motivate by structural representation and compositional account the lexical mismatches.

The transfer rule of *höchstens* in MDS consented the first option as shown in ex.(38):

(38) höchstens → only_possibly

In addition, we provided an analysis of the interpretation of *höchstens* in the context of VerbMobil and informally proposed ways to consider the second option, which are briefly discussed in the following.

In the two examples above *höchstens* occurs in contexts where possibilities about temporal location of one event are described. The possibility is denoted in the first example by the conjunctive, and the meaning of the modal verb *können* itself. In the second example – by the noun *Möglichkeit* (possibility), and the conjunctive of *sein* (to be) – *wäre*. Furthermore, the morphology of *höchstens* is a superlative degree of the adverb *hoch*. The comparative degrees of adverbs and adjectives have particular semantic content. Thus, information about the superlative degree and the scalar character of the adverb should be available in the semantic lexicon, and information about the semantic content of the entity the adverb has scope over (in this particular case – a *possibility*) should be provided. The interpretation of the combination between the meaning of the superlative, the scale and the possibility derives justified lexicalisation of *höchstens* into *only* and *possibly*, which corresponds to the intuitions conveyed by the examples above ex.(36), ex.(37)[19].

In order this to be realized, it is necessary to introduce the relevant distinguishing marks at relevant places in the lexica of the system, and to make sure that the representation of the right semantic structures is possible.

4.6 Disambiguation

The highly ambiguous adverb *noch* will be our example to show the process of disambiguation of focus adverbs in MDS. We considered two readings of this adverb: 1) noch temporal ex.(39), 2) noch eventive ex.(40), which reflect the semantic entity each of them has scope over. *Noch* in the first reading has scope over temporal location of an eventuality described, and in the second reading – over the event described. These two readings were felicitously translated into the English *still*, and *just*.

(39) *noch* temporal → *still*

KA:11:MPS1_1_03:
tut mir leid, am 13ten April, bin ich NOCH im Urlaub.
I am sorry. on the thirteenth of April I will STILL *be on vacation*

(40) *noch* eventive → *just*

HI:2:MPS1_1_09:
Wenn Sie mir NOCH kurz erklären wie ich zu Ihnen komme
If you would JUST *briefly explain how to reach you*

The lexical entry of *noch* contains two disjoint FocusOp relevant each for one of the two cited readings ex.(41).

(41) `lex(noch) => focus_adv_sem(noch,temp;event).`

The semantic construction delivers an ambiguous output, as the value of the phi_op contains two disjoint values ex.(42).

(42) Ende Juni bin ich *noch* im Urlaub.

[19]The lexical entry for *höchstens* should contain the following information: "this is a focus adverb, which is scalar (i.e. it refers structurally to a semantic entity, which can be evaluated through a scale), and denotes to the superlative value of the scale. What scale is exactly considered is determined structurally through the scope of the adverb. If the scope is on a semantic entity, which describes a possibility, regardless from the fact whether this Information comes from a verb, or from a name, one looks for the quantitative values of this scale of the possibilities, and at the end one should find that that there is only one possibility which could be at the superlative value of the scale of possibilities. After all this the lexicalisation of *höchstens* into the English *only* can be justified. Moreover, this interpretation corresponds to the intuitions conveyed by the examples above.

$$\left[\begin{array}{l} DRS \\ \left[\begin{array}{ll} DRS\_t & \\ phi\_condition & \\ phi\_arg => & \left[\begin{array}{l} im\_Urlaub\_sein: \boxed{1} \\ \end{array}\right] timeloc : Ende\_Juni \\ phi\_op : temp; event & \\ phi\_pred : noch & \end{array}\right] \end{array}\right]$$

The disambiguation of *noch* takes place at the level of Transfer. The marks for disambiguation were the semantic indexes of the sorts of the eventuality, which was in the scope of the adverb. Thus, a stative eventuality triggered the temporal reading of *noch* ex.(43), and an event triggered the eventive reading of *noch* ex.(44).

(43) Ende Juni bin ich *noch* im Urlaub.

$$\left[\begin{array}{l} DRS \\ \left[\begin{array}{ll} DRS\_t & \\ phi\_condition & \\ phi\_arg => & \left[\begin{array}{l} marker \\ sort : static \\ to\_be\_on\_vacation : \boxed{1} \\ \end{array}\right] timeloc : end\_of\_June \\ phi\_op : temp & \\ phi\_pred : still & \end{array}\right] \end{array}\right]$$

(44) Ich erkläre *noch* kurz.

$$\left[\begin{array}{l} DRS \\ \left[\begin{array}{ll} DRS\_t & \\ phi\_condition & \\ phi\_arg => & \left[\begin{array}{l} marker \\ sort : dynamic \\ kurz\_erklären : \boxed{1} \\ \end{array}\right] \\ phi\_op : event & \\ phi\_pred : just & \end{array}\right] \end{array}\right]$$

The conditions for disambiguation are integrated in the two TAU rules produced to cover the two readings of *noch* ex.(45), and ex.(46).

(45)
```
tau_lex(noch,still,[tau(#Mod,#Args)],#Args,mod([#Mod]) &
sem:idx_sem(sort:statisch_c)) => sem_t.
```

(46)
```
tau_lex(noch,just,[tau(#Mod,#Args)],#Args,mod([#Mod]) &
sem:idx_sem(sort:~statisch_c)) => sem_t.
```

SourcePred	→	TargetPred
alternativ	→	alternatively
auch	→	too
ausserdem	→	furthermore
dann1	→	then1
denn1	→	null_pred
doch	→	after_all
erst	→	null_pred
erst	→	only
hoechstens	→	only_possibly
ja1	→	null_pred
insofern	→	so_far
mindestens	→	at_least
noch	→	still
noch	→	just
nochmal	→	again
nur	→	only
selbst1	→	even
schon	→	already
sogar	→	even
sonst	→	otherwise
wenigstens	→	at_least
wieder	→	again
wiederum	→	on_the_other_hand1
wohl	→	null_pred
zumindest	→	at_least
ausnahmsweise	→	for_once
fruehestens	→	at_the_earliest
spaetestens	→	at_the_latest
spaeter1	→	later1

Table 3: Translation equivalents of PredNames of focus adverbs.

4.7 Transfer PredNames of Focus Adverbs in MDS

The transfer of focus adverbs was basically carried out at level of PredNames. The shape of the transfer rule is given in ex.(47) below.

(47)
```
tau_lex(SourcePredName,TargetPredName,[tau(#Mod,#Args)],
#Args,mod([#Mod]) => sem_t.
```

The German PredNames with their English equivalents are listed informally in table 3.

The following section outlines the results of the semantic analysis of focus adverbs, which were not implemented in MDS. It addresses the problems of ambiguities, and heuristics for disambiguation in the processing of *focus adverbs*.

5 Intensifiers

This section describes the treatment of *intensifiers* in the Transfer module of MDS. The subclass of *intensifiers* has been determined as having the property to apply to *adverbs* or *adjectives*, i.e. *modifiers* with the semantic effect to introduce additional information on the degree of intensity of the modifiers (ex.(48a-b)).

(48) a. Peter kommt SEHR(int) SPÄT(adv).

b. Peter ließt ein SEHR(int) INTERESSANTES(adj) Buch.

Thus, an intensifier and a modifier form one constituent, which relates as a whole to the rest of the expression it occurs in.

5.1 Semantic Construction and Tranfer of Intensifiers

The intensifiers in MDS are designed as applying to *dimensional adjectives*, which occur in expressions as adjectives or as adverbs (ex.(49a-b)).

(49) a. Peter kommt SEHR(int) SPÄT(adv).

b. Wir machen einen SEHR(int) SPÄTEN(adj) Termin aus.

The intensifiers are represented within the dimension condition introduced by the dimensional adjective. They are referred to with the feature: DIMEN_INTENSITY (ex.(50)).

(50) Peter kommt SEHR SPÄT.

$$\begin{bmatrix} DRS \\ \begin{bmatrix} kommen: [1] \\ \begin{bmatrix} dimen\_condition \\ dimen\_inst: [1] \\ dimen\_intensity: sehr \\ dimen\_pred: spaet \\ dimension: timeloc \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

A special TAU rule provides the transfer of this semantic group see ex.(51), which combines the lexical TAU rule with one semantic macro.

(51)
```
tau_lex(SourcePred,TargetPred,tau_intens(#Args,#Sign),
#Args,#Sign) => sem_t.

@tau_intens(list,sign) => list.
tau_intens(#Args,ad_syn(#Mod & pred_name(#SourcePred))) =>
    true(tau_lex(#SourcePred,#TargetPred,[#XPSem],#Args,#Mod)) &
    [sem_lex(#TargetPred,[#XPSem]),#XPSem].

tau_intens(#Args,ad_syn(#Mod & pred_name(#SourcePred))) =>
    true(tau_lex(#SourcePred,#TargetPred,[#NPSem,#XPSem],#Args,#Mod)) &
    [sem_lex(#TargetPred,[#NPSem,#XPSem]),#XPSem].
```

SourcePred	→	TargetPred
echt2	→	null_pred
echt2	→	really2
durchaus	→	absolutely
eher	→	rather1
etwas1	→	a_bit1
sehr	→	very1
ueberaus	→	extremely
zu3	→	too1

Table 4: Translation equivalents of PredNames of intensifiers.

5.2 Size of the Data and Transfer PerdNames for Intensifiers

The intensifiers in the Word list for the Demonstrator (after sem_lex2.stuf) count seven:

echt, durchaus, eher, etwas, sehr, überaus, zu.

Five of them occur in the Test suite of Dialogues for MDS:

echt, eher, etwas, sehr, zu.

The transfer PredNames of intensifiers are informally listed in table 4.

5.3 Future Work

The semantic classes of adverbs and adjectives which can combine with intensifiers are still to be set apart. Furthermore, some of the adverbs classified in the group of standard adverbs can occur in expressions as intensifiers (ex.(39)). Deeper semantic analysis of the semantic and combinatoric properties of intensifiers will affect the present subdivisions of the classes of adverbs, and will provide conditions for even more effective transfer.

6 Standard Adverbs

This section describes the treatment of *standard adverbs* in the Transfer module of MDS. The semantic subclass of *standard adverbs* illustrates the initial general conception of the role of adverbs as modifiers in VerbMobil. They have the property to apply syntactically to an entire expression, and to refer semantically to different perspectives or circumstances of the eventuality described by the expression. This structural definition did not account for further details concerning the semantic roles of the modifiers. We will present in the following section the design of *standard adverbs* in the Semantic Construction module of MDS.

6.1 Standard Adverbs in the Semantic Construction Module of MDS

Standard adverbs are analysed as separate entity in the semantic representation, they introduce a BASIC CONDITION, which only contains an explicit PredName, as shown in ex.(52).

(52) LEIDER komme ich montags.

$$\begin{bmatrix} DRS \\ \begin{bmatrix} kommen: \ [1] \begin{bmatrix} tlocation: montags \\ inst: \ [1] \end{bmatrix} \begin{bmatrix} basic\_condition \\ pred: \ leider \\ inst: \ [1] \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

6.2 Size of the Data

Standard adverbs in the Word list for the Demonstrator (after sem_lex2.stuf) count twenty two:

beinahe, derart, etwa, gar, genaugenommen, glücklicherweise, halbwegs, hindurch, leid, leider, meinetwegen, nah, offensichtlich, pünktlich, überhaupt, umsonst, unglücklicherweise, weg, zusammen, besonders, insbesondere, insgesamt.

Two of them occur in the Test suite of Dialogues for MDS:

leid, leider.

Most of the listed adverbs can be intuitively assigned semantic properties of the defined in MDS subclasses. For example *überhaupt* can be analysed as focus adverb, as it has scope over different entities (ex.(9a-c)). *Leider* and *unglücklicherweise* can be classified as modal adverbs, as they seem to introduce a modality connected to previous discourse, as *allerdings* does (see ex.(52), and ex.(53), and compare with ex.(20), ex.(21), and ex.(22)).

(53) WIL016/GRA017:
UNGLÜCKLICHERWEISE habe ich am Mittwoch, den achten Juno wieder ab mittags eine Konferenz hier in Hamburg.
UNFORTUNATELY *on Wednesday the eighth I have a conference in Hamburg.*

Beinahe and *etwa* can be in the semantic subclass of intensifiers, as they also apply to other modifies (see ex.(54) and compare with ex.(49a-b)).

(54) MPS1_1_19:
Ist bei mir ETWA SCHLECHT(adv).
That's not SO *good.*

Finally *offensichtlich* which is morphologically an adjective, can be assigned only the semantic class of dimensional adjectives.

SourcePred	→	TargetPred
beinahe	→	almost
derart	→	so
etwa	→	a_bit
etwa	→	somewhat
etwas2	→	a_bit
gar	→	at_all
genaugenommen	→	strictly_speaking
gluecklicherweise	→	luckily
halbwegs	→	halfway
halbwegs	→	more_or_less
hindurch	→	through1
hindurch	→	throughout1
leid	→	sorry
leider	→	unfortunately
meinetwegen	→	for_my_part
nah	→	near1
offensichtlich2	→	obviously
puenktlich	→	sharp1
ueberhaupt	→	null_pred
ueberhaupt	→	generally
umsonst	→	for_nothing
ungluecklicherweise	→	unfortunately
weg1	→	away1
zusammen1	→	together
besonders	→	mainly
insbesondere	→	above_all
insgesamt	→	altogether

Table 5: Translation equivalents of PredNames of standrd adverbs.

6.3 Future Work

Many of the adverbs classified as *standard adverbs* seem to belong to other semantic subclasses. This makes it difficult to motivate the existence of a separate class of standard adverbs. It is necessary to revise the semantic status of the group of *standard adverbs* in comparison with the other semantic subclasses of adverbs. Furthermore it is necessary to review the listed as standard adverbs in MDS lexemes, and reclassify them in order to assign them the appropriate semantic subclass according to their semantic properties.

6.4 Transfer PredNames of Standard Adverbs in MDS

The determination of the readings and the PredNames of the group of *standard adverbs* was pursued after the adopted strategies in the Transfer module. The transfer PredNames of *standard adverbs* are informally listed in table 5.

The transfer rule for standard adverbs is given in ex.(55) below.

(55)
```
tau_lex(SourcePred,TargetPred,[tau(#Mod,#Args)],
#Args,mod([#Mod])) => sem_t.
```

7 Transfer Rules for Adverbs in MDS

The readings of ambiguous German lexemes were transfered by means of more than one PredName, and the number of transfer rules was at the end greater than the number of the German lexical entries from the semantic lexicon. The relation between the number of lexical entries in the German semantic lexicon, and the number of produced transfer rules are given in tables (6) and (7)[20].

ADVERB CLASS	No of LE	No of tau_rules
Modal Adverbs	32	63
Focus Adverbs	33	41
Intensifiers	7	10
Standard Adverbs	23	35
Disc_rel Adverbs	27	62
Negativ Adverbs	1	1

Table 6: Number of lexical entries 1.

ADVERB CLASS	No of LE	No of tau_rules
Temporal Adverbs	55	4 special transfer rules and 32 tau_rules
Interrogativ Adverbs	20	1 special transfer rule
Pronoun Adverbs	18	1 special transfer rule

Table 7: Number of lexical entries 2.

The transfer rules for adverbs were built on the basis of the semantic predicates (PredNames) by means of lexical transfer rules of the general form, shown in ex.(56):

(56)
```
tau_lex(SourcePredName,TargetPredName,[tau(#Mod,#Args)],
#Args,mod([#Mod])) => sem_t.
```

Some groups of adverbs with special semantic status were transfered by means of TAU rules of different form, which were given with details in the appropriate subsection.

[20]**Legend:**

1. No of LE = Number of lexical entries in sem_lex2.stuf
2. No of tau_rules = Number of tau_rules

References

[Bos95] Johan Bos. Focusing Particles and Ellipsis Resolution. Verbmobil-Report 61, Universität Saarlandes, 1995.

[Ebe95] Kurt Eberle. Zu einer Semantik für Dialogverstehen und Übersetzung. VerbMobil-Report 83, Juni 1995.

[Kön91] Ekkehard König. *The Meaning of Focus Particles. A Comparative Perspective.* Routeledge, London and New York, 1991.

[Lex94] Theodor Lexandowski. *Linguistisches Wörterbuch.* Quelle & Meyer, 1994.

[McG94] Scott McGlashan. Lexical Semantic Macros, September 1994.

[MD94] Martin Emele-C.J. Rupp Michael Dorna, Kurt Eberle. Semantik-orientierter rekursiver Transfer in HPSG am Beispiel des Referenzdialogs. VerbMobil-Report 39, Oktober 1994.

[PT91] Veronika Calderwood-Schnorr Wendy V.A. Morris Peter Terell, Roland Breitsprecher. *PONS. Komparativwörterbuch. English-Deutsch.* Klett, Verlag für Wissen und Bildung, Stuttgart, 1991.

[SF95] Birte Schmitz and Kerstin Fischer. Pragmatisches Beschreibungsinventar für Diskurspartikeln und Routineformeln anhand der Demonstratorswortliste, Juni 1995.