Hans Kamp, James Pustejovsky (editors):

**Universals in the Lexicon: At the
Intersection of Lexical Semantic Theories**

Dagstuhl-Seminar-Report; 60
29.03.-02.04.93 (9313)

Dagstuhl-Seminar 9313:
Universals in the Lexicon

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July 11, 1994

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1   Titles of presentations

The following is a list of the titles of the presentations given:

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The introductory part of the seminar was devoted to three broader presentations, one from each of the fields of semantics, lexicography and AI/NLP system building:

- ATKINS: Lexical data collection in the corpus age: a view from the lexicographical wordface
- INGRIA: Standards for structuring the lexicon
- KAMP/PUSTEJOVSKY: The place of the lexicon in a computational semantics for natural languages

2   Introduction (Hans KAMP)

The lexicon is generally looked upon as the depository of all that is idiosyncratic about the basic constituents of a language, - as a place where one can find out the meanings of its words and affixes, as well as whatever is special about their syntax, morphology and phonology. A lexicon or dictionary that lives up to these expectations must contain a huge amount of apparently unrelated facts. Traditional dictionaries seem to prove the point. The wealth of information a good dictionary provides is spectacular. But, as lexicographers would be the first to admit, it is not easy to perceive any real systematicity in the welter of data it has to offer.

Lexicographers would also be ready to admit that even the best dictionaries supply only part of the information which they should contain if they were to capture all that is known about the meaning and use of the words to a native speaker. But what is missing from existing dictionaries is not just more of the kind of information they already contain. As linguistic theory deepens we are coming to realize that there are all manner of things about the meaning and function of individual words that are an essential part of linguistic knowledge but none of which can be found in any conventional dictionary.

These more global deficiencies of existing lexica are brought to our attention with particular force by work in computational linguistics, most particularly through the reflections such work entails about the lexical information that should be available to sophisticated language processors (such as cooperative question-answering systems or machine translation systems with substantial coverage). Lexica that answer to the needs of such systems must be very different from any dictionary that is on the market today.

In fact, such lexica will not only have to contain a lot of new information, they also will have to be able to respond to particular kinds of query from other components of the system, by supplying just the right information in the right form. These tangible demands that computational architectures place on the retrievability and form as well as the content of lexical information mirror current convictions about the content and organization of the mental lexicon; this is one of the many areas where Artificial Intelligence and Cognition seem to go hand in hand.

A central, practically and linguistically important aspect to the matter of form and content of lexical information is what general principles support the mental lexicon and might serve as guidelines in the design of computational dictionaries. It has long been felt and often been claimed that there is still much to be discovered here, much that has to do with conceptual organization and with global choices that individual languages make with regard to lexical realization of conceptual structure. That such general principles exist is witnessed by, among other things, the numerous productive and semi-productive lexical processes that create new words out of existing ones or that assign old words new meanings. Such processes have long been a topic of

linguistic interest. Some of them were subjected to close and illuminating scrutiny during the Dagstuhl meeting. But, as the meeting made clearly visible, they are ultimately just symptoms of a more fundamental conceptual organization.

These days such fundamental questions loom large in many areas of lexicon-related research, and they are reflected in, and often they have inspired, a spectrum of specific problems with which various research groups are currently concerned. It was out of an awareness of this that the idea of a Dagstuhl workshop on Universals in the Lexicon was born; and it was out of that same awareness also that the organizers strove to bring together lexicographers, linguists, computational linguists and philosophers whose professional careers have not so far given much occasion for scientific interaction. Indeed, those who found themselves thrown together between March 29 and April 2, 1993, might well have been described as a motley collection - a description that will no doubt have crossed the mind of more than one of those present. If it hadn't been for the fact - which we came to realize more clearly as time went on - that all of us were in some way or other bothered by the general questions hinted at above, the impression of being just a motley collection might well have prevailed until the end. But as it turned out, a sense of understanding and common purpose did develop. This alone, we think, should have been enough to call the meeting a success.

As a matter of fact the meeting accomplished a good deal more. The lexicographers succeeded in making plain to those linguists, computer scientists and philosophers who still needed persuading that trying to come up with an adequate description of just about any lexical item is likely to bring to light unexpected riches and complexities; that these complexities arise already within a setting of "classical" lexicography; and that it is anything but a trivial matter to make proper use of the extensive resources that are no available in the form of large electronically stored corpora. Many of the linguists lifted, with their detailed studies of particular words or small groups of words, as many tips of the lexical veil that still hides most of the conceptual structure that lies below it from our view. While it would be foolish not to realize that most of this structure remains invisible, it can nonetheless be said that there is quite a bit that today we can see much more clearly than we could ten or even five years ago.

Finally, the philosophers and some of theoretical and computational linguists pointed towards a new direction in lexical research by stressing the connections between lexical meaning, discourse structure and inference (including, in particular, defeasible inference). This may well have been the first meeting devoted entirely to matters of the lexicon in which this aspect of lexical semantics has come into focus with such force and clarity. It is a direction whose importance may be expected to grow with time. For the connections on which it concentrates are crucial both to the theory of cognition and to the theory of computation. But it is a dimension of lexical knowledge of which we understand precious little at the present time.

Thus the result of the meeting should be characterized as a web of problems rather

than a set of solutions. But even in the world of problems the whole is often more than the sum of its parts.

3 Abstracts of presentations

3.1 ARMSTRONG-WARWICK/HEYLEN: **Collocations, dictionaries and translation**

Collocations are an inspiring source for making hypotheses concerning all kinds of lexical semantic issues. In translation (both human and machine) they pose specific problems. For the native speaker of English it may be obvious that someone who smokes a lot is a *heavy smoker*, for the non-native speaker it could have been *large, strong* or *big smoker*.

The presentation reports on work from the project "Collocations and the lexicalisation of semantic operations". The main focus has been on the semantics involved in collocational constructions using the lexical function approach as elaborated by MEL'ČUK and his followers. We have investigated whether each collocation can be assigned such a function and whether these functions make any sense in view of an abstract representation to serve as an interlingua.

In order to test these and related questions, which is partly a matter of empirical investigation, we turned to dictionaries to collect more data. Dictionaries provide a wealth of information about collocations, not only in the examples they list but also the semantic clues accompanying the words and expressions. Semi-automatic "chaining" through mono- and bi-lingual dictionary entries has given us a wide variety of data across numerous languages. We are working on identifying the classes and regularities we see in this data towards a better understanding of the semantics of collocations.

3.2 ASHER/AURNAGUE/BRAS/VIEU: **Space, Time and Discourse**

While the effects of the semantics of tense and adverbials on the temporal ordering of eventualities introduced in a natural language text (henceforth the temporal structure of the text) has been studied in frameworks like that of Discourse Representation Theory (DRT), the natural extension of this investigation, the spatiotemporal structure of the text (spatiotemporal ordering of eventualities and objects introduced in the text), has been neglected. Nevertheless, the spatiotemporal structure of a text appears to be built along the same principles as the simpler temporal structure of the text. Our thesis is that the spatiotemporal, as well as the temporal, structure is determined by the discourse structure of the text. We use the formal discourse framework of SDRT proposed in ASHER (1993) and the associated reasoning mechanism DICE (Discourse in Common Sense Entailment) in LASCARIDES and ASHER (1991) to give an alternative account of the semantic contribution of tense to the temporal structure of a text and to determine a spatiotemporal structure for the text. Although there

have been numerous and careful, descriptive linguistic studies of the spatiotemporal characteristics of prepositions and movement verbs, the spatiotemporal structure of texts has eluded a precise, formal treatment until now.

ASHER (1993) presents a theory of discourse structure, Segmented Discourse Representation Theory or SDRT, which serves as the framework for our analysis. The basic building blocks of discourse structure are propositions with a dynamic content, which we will represent as DRSs. However, constituents of a discourse structure may be more complex and must be defined recursively. In SDRT, a natural language text is represented by a SDRS, which is a pair of sets containing respectively: the SDRS or DRSs representing respectively sentences or text segments, and discourse relations between them. These structures are constructed in a dynamic fashion like DRSs. The basic constituents are derived from single sentences or clauses and are DRSs. To build an SDRS for a text, we proceed sentence by sentence, adding the DRS derived from each sentence to the structure until there are no more to be analyzed. Since an SDRS, unlike a DRS, is a structured object, information derived from sentence S_{n+1} may be added at several points to the SDRS constructed from $S_1, \ldots, S_n$. Roughly, the acceptable attachment points are along the "right frontier" of the structure (see ASHER 1993 for a discussion). The principal difficulty in defining a discourse structure for a text, and hence its associated temporal order, involves the inference of discourse relations. Discourse relations, modelled after those proposed by HOBBS, MANN and THOMPSON, link together the constituents of an SDRS. These relations constrain temporal and spatiotemporal structure. Discourse relations between constituents are inferred in a nonmonotonic logic of ASHER and MORREAU (1991). The language of this logic is that of first order logic augmented with a nonmonotonic conditional operator, >. LASCARIDES and ASHER (1991) develop a theory for inferring discourse relations which they call DICE. DICE is the component of SDRT which contains axioms for inferring discourse relations by default. These axioms may combine world-knowledge with the contextual information that a particular discourse attachment affords. While DICE was developed to account for temporal structure in English, some of us have recently used it in the analysis of the temporal structure of French (ASHER& BRAS 1993). Here we extend and refine the theory to take account of spatiotemporal structure. To treat spatial anaphora, we have to add to the SDRT framework elaborated so far. There is no grammatical counterpart for tense for location, so only adverbials and discourse structure will tell us how locations move in the text. Instead, we must exploit certain facts about lexical semantics. Some eventualities are changes of state – in particular verbs of movement which are changes of location. Together with the tenses and spatial and temporal adverbials, they help determine the spatiotemporal structure of the simple texts we have examined. Following previous work (AURNAGUE & VIEU in press), we distinguish between places, objects, eventualities (states and events), and their spatiotemporal locations. Spatiotemporal relations between these referents are axiomatized in a theory of space-time, derived from CLARKE's calculus of individuals (1981). This theory is used to represent the geometrical aspects of the lexical semantics of static relations, especially those de-

noted by prepositions. As to the lexical semantics of movement verbs, we have started from the descriptions of BOONS (1987) and LAUR (1991) which associate three locations with any movement verb: the source, the goal, and the journey or path from source to goal. The authors mentioned above use these locations to divide movement verbs into three classes – final oriented verbs (come, venir), median oriented verbs (errer, wander through) and initial oriented verbs (partir, leave). The significance of these classes can only be understood at the discourse level, however. We define Source(e) as a place whose spatiotemporal referent contains or is in contact with the initial part of e. Similarly for Goal(e) and finally Path(e) will be a set of sequences of places. A path is a set of sequences because we need to allow for descriptions at different granularities. The lexical entry for a verb of movement then will include a number of implicit argument places, some temporal and some for places. As the construction procedure proceeds, these argument places will be either filled in by the contributions of adverbial phrases, the discourse referents introduced by the inflection node, or filled in by discourse referents that result from the "existential scavenging" (for a discussion of this see ASHER 1993). These argument positions are subject to constraints that derive from lexical semantics. We distinguish between three sorts of verbs or verbal complexes with respect to the linearity of motion: linear motion verbs, nonlinear motion verbs and nonmotion verbs. They can be defined precisely within our geometrical and topological framework. Now we add our information about the effects of discourse structure on spatiotemporal structure. To model the effects of the orientation of the motion verbs, we suppose the existence of a contextually salient location (CSL) for each constituent; axioms determine the nature of the CSL relative to lexical information and information about the discourse context. Here is one example of such an axiom:

$$\text{Narration}(A_i, B_j) \rightarrow (\text{Target}(e_i) = \text{Target}(e_j) \rightarrow \text{Source}(e_j) = \text{CSL}(A_i))$$

Just as Narration in the temporal domain moves the events along in a sequence, it also moves the CSL in a sequence of linear motions. For narration, however, it seems that the locational structure of the text behaves in the way described only when the target is the same in the two constituents. Other relations impose different constraints. Still other axioms encode the effects on the locational structure of texts noticed in the verb classifications of BOONS and LAUR. We have developed a uniform theory that integrates spatiotemporal information, semantic rules for tense and laws that exploit information about the discourse context. This theory nonmonotonically implies determinate temporal, spatiotemporal and discourse structures for simple French texts. We have verified that our theory handles the cases of temporal anaphora that the classical DRT analysis is able to treat. We also have been able to account for examples that elude the classical analysis. We are able to give determinate temporal structures to texts that classical DRT analyses cannot handle. Our theory also allows us to determine from a discourse structure that is inferred using nonspatiotemporal informationspatiotemporal locations for various objects. Future work will include the expansion of the type of texts and discourse relations treated and also a treatment

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of ambiguity, which our present formalism does not represent adequately.

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3.3 ASHER/LASCARIDES: **Lexical Disambiguation in a Discourse Context**

How is discourse information used to take lexical decisions, and lexical information used to take discourse decisions? In this paper, we observe data that illustrate the information flow between the semantics of words and the structure of discourse. The data show how lexical information influences inferences about which rhetorical relations underly an NL text, and how discourse structure affects lexical (sense) disambiguation of homonymous words. We go on to explore how a formal theory of discourse interpretation can be augmented with a theory of lexical semantics, so that this information flow can be modelled.

In order to place a theory of lexical disambiguation into a discourse context, we require a formal model of discourse structure, and a formal model of discourse attachment, in which implicatures are calculated on the basis of world knowledge and pragmatic heuristics. We also require a formal language for representing lexical information. These three ingredients must be mixed together in a unified account of NL interpretation, which makes precise the above accounts of how information flows between words and discourse. For the account of discourse structure, we use Asher's (1993) account of Segmented Discourse Representation Theory (SDRT), which contains a semantically based account of discourse structure and which, crucially, comes in tandem with a formal theory of discourse attachment. The theory of discourse attachment,DICE, computes which rhetorical relations glue together the propositions introduced in an NL text, given their semantic content and the reader's background knowledge. To represent lexical structures, we use Copestake and Briscoe's (1991) Lexical Knowledge Base (LKB). They use typed feature structures (FSs) to represent lexical information. There are two main reasons why this is advantageous from our perspective. First, this allows a tight interface between syntax and semantics. This is an essential requirement if we are to explore interactions between the various knowledge resources recruited during text processing. Second, it is possible to supply a modal semantics to typed FSs (Blackburn 1992), and given that DICE uses a modal logic, the lexical framework proposed by Copestake and Briscoe is amenable to integration with DICE.

In the full paper, we show how lexical processing can work in service to a theory of discourse attachment. But the knowledge resources encoded in a theory of discourse attachment are also of use in lexical processing. Consider the following examples and the ambiguities in them concerning the words 'plant', 'bar' and 'dock'.

- They ruined the view.

- They improved the view.

- They put a <u>plant</u> there.

- The judge demanded to know the whereabouts of the defendant Ross.

- The barrister mumbled apologetically, and said that Ross had last been seen drinking heavily.

- The judge told the bailiff to escort Ross from the <u>bar</u> to the <u>dock</u>.

We argue that *bar* in the second example is disambiguated to its pub sense on the basis of constraints on coherent discourse. In contrast, and *plant* in the first example is disambiguated on the basis of strengthening the rhetorical link between the sentences. In the full paper we show how these proposals can work in formal detail.

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3.4 ATKINS: **Lexical data collection in the corpus age: a view from the lexicographical wordface**

Lexicographers mining corpora scrabble in semi-darkness amongst the dirt and dust of used words, fighting for breath, mopping their brows and wiping worddust from their eyes as they grope around for nuggets of gold. (Gold is lexical data.) When they find it, sometimes it's easy to say what kind of gold it is and know what to do with it; sometimes it's hard; sometimes it's downright impossible. Sometimes they find something they think isn't gold, and throw it back. Were they right? They suspect that everything they touch is gold, if only they could see clearly. Sometimes they are looking for a particular kind of gold and can't find it. Often they wish they'd brought stronger lamps. (Lamps are the policy guidelines given them by the database designers.) Sometimes they wish they had an Obi-Wan Kenobi there with them to suggest a better way to go about some of this. (Obi-Wan Kenobis are theoretical linguists.) They know they would do better if their tools for handling the corpus stuff were more mechanized. (Tools are tools are tools.) How are they doing, in 1993?

The title reflects my view of the world. This will be a personal look at where computer-assisted lexicography stands at present; how far it has come; where it might

be going to; what the major obstacles are that it still has to overcome; where the solutions might come from.

Some of the problems: What types of information *must* be recorded? Do individual senses of words really exist? How can you record them so that you don't lose the sense of their closeness or distance vis-a-vis each other in semantic space? What is valency? What is the best way to record grammatical facts? How do these relate to word meaning? How can you handle register? What is the best methodology? How can a dozen lexicographers label meanings in a corpus and build a database in such a way that the work is (a) consistent; (b) accurate; (c) theoretically sound; (d) linguistic-theory-neutral; (e) useful for dictionary makers; and (f) economically viable?

I shall outline the major problems highlighted by the availability of online texts as lexicographical evidence. These are for the most part problems in the identification and coding of properties of words, including semantic relationships, sense differentiation, systematic polysemy and lexical implication rules; complementation, subcategorization and transitivity, Aktionsart, unexpressed objects of verbs; complementation and countability in nouns, as well as their use with determiners and quantifiers, restrictions on their clause role, and their modification by and of other nouns; and type, complementation and stativity of adjectives; and (last but not least) the many and various problems associated with all types of multiword item, from the most flexible and transparent of collocations to fixed and opaque idiomatic phrases.

3.5 BIERWISCH: **Types of lexical information**

A crucial condition to be imposed on any theory of Universal Grammar is that it provides a general schema for the organization of lexical entries. Formally, lexical entries are abstract data structures interrelating (at least) four types of information:

1. Phonetic Form, specifying the idiosyncratic properties of the sound pattern of the entry;

2. Semantic Form, specifying the invariant conditions on the entries' conceptual interpretation;

3. Grammatical Form, indicating the morpho-syntactic categorization of the entry;

4. Argument Structure, indicating the type of optional and obligatory complements of the entry and the morphosyntactic conditions imposed on them.

The main interest of the paper will be in the constraints UG imposes on Semantic Form, its relation to Conceptual Structure and the way it supports argument positions.

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The proposal will be explored that Conceptual Structure is basically given in the format of DRS-representations, such that Semantic Form represents the grammatically relevant conditions on DRS-configurations providing the interpretation of linguistic expressions containing a given lexical entry. Consequences for the determination of Argument Structures and their syntactic and semantic saturation will be formulated and illustrated.

The target of the paper is to develop a proposal of UG-conditions on lexical entries, that integrates basic assumptions of DRT with a minimalistic, lexicon-based theory of syntax.

3.6 BRISCOE/COPESTAKE/LASCARIDES: **Capturing regular sense extensions in the lexicon**

Some types of sense extension appear to be sufficiently pervasive as to warrant a rule-governed account that derives the extended senses from the basic ones. For example, it would be useful to specify a law that grinds nouns denoting animals into mass nouns denoting the edible flesh of that animal; so *haddock* becomes *haddock* meaning meat, *lamb* becomes *lamb* meaning meat, and so on. This law must be defeasible, however, since the meat sense of *pig* is highly marked, being blocked by the underived leixical item *pork* that has the same semantics as the derived meat sense of *pig*. We review extant accounts of blocking, and argue that they are inadequate on the basis that they treat blocking as an absolute principle of lexical organisation. But *pig* meaning meat can be 'unblocked' for discourse effect; for example, when a vegetarian utters *"There was a pig on the menu."* We offer a new account of blocking which treats it as a default principle of lexical organisation, and we suggest ways in which this account can be formalised in the non-monotonic logic Commonsense Entailment [ASHER/MORREAU 1991].

3.7 CROFT: **In the vicinity of a theory of metaphor**

This paper explored in some critical detail certain problems and proposals emerging from the LAKOFF ET AL. view of conventional linguistic metaphor as a conceptual mapping from the "literal" (source) domain to the "metaphorical" (target) domain. The phenomenon of conventional metaphor was delimited to exclude certain well-known coercion or construal phenomena sometimes described as methaphor. A critical element of the domain shift theory of metaphor is a definition of "domain", and LANGACKER's definition of a domain as a *Fillmorean frame* which can be further nested in their domains/frames. Metaphor is defined as domain shift, in contrast to metonymy as domain highlighting. Finally, conventional metaphors that are fundamental parts of the lexicon were distinguished from literary figures of speech that are not conventions of the language.

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Various English metaphorical mappings were shown to vary in their generality (schematicity) and productivity. Metaphors can be defined more narrowly in their semantic scope so that systematic exceptions can be excluded (The notion of domain as frame allows for a more narrow characterization of the relevant domains.). Nevertheless metaphors still vary in productivity, so that not all words in the appropriate source domain can be used metaphorically in the target domain.

The possibility of establishing constraints on possible metaphor mappings was explored. There are at least two relations between source and target domain that license metaphorical mappings:

1. repeated cooccurrence in ordinary experience leads to an association and transfer from one domain to the other ("invited inference"/"experientially based metaphors");

2. the domain matrices of the source and target domain share a subdomain, thereby facilitating a transfer of conceptual structures from the unshared subdomains.

A more difficult problem is the delimitation of what conceptual structures are mapped into the target domain. LAKOFF's *Invariance Hypothesis*, that all and only the "image-schematic" structure is transferred, was shown to be a necessary but not sufficient condition. However, it appears that all "image-schematic" structures do actually belong to "abstract" domains in a concept's domain matrix, so some other property will have to be used to delimit what conceptual structures map into the target domain.

3.8   FILLMORE: **What makes nouns so difficult?**

Contrary to the usual assumption that the semantic/syntactic description of verbs is complex and interesting, while that of nouns is trivial and straightforward (they mainly serve after all to name the arguments of verbs), I tried to show that the description of semantically complex nouns involves at least two layers of complexity, and in many cases three.

If a noun is the name of a complex state of affairs, an institution, a relation, an event, or an experience, then it is necessary to describe its "internal" syntax and semantics (including the means by which the elements of its semantic frame may be realized as complements and/or specifiers of the noun) and its "external" syntax and semantics with respect to its function as the grammatical head of a noun-phrase, e.g., its interaction with the semantics of modification, determination, singularity/plurality, boundedness (its count/non-count character), quantification, etc. There is often a third layer of complexity, in case the resulting noun-phrase is collocationally tied to its "governor".

The main examples were of the English nouns *risk* and *sight*, each of which was shown to require a dozen or more descriptions, depending on lexical or constructional context.

3.9   FILLMORE: **Frame semantics and perception verbs**

It was suggested that the distributional commonalities of verbs of perception are related to the features shared by the psycho-physical realities of sensation/perception in general, across all the modalities, and that their differences tend to parallel differences in both the realities and the folk models of perceptual experiences in the individual modalities. It was suggested that generalizations relating linguistic facts to perceptual facts linked the modalities in a cycle Visual-Auditory-Olfactory-Gustatory-Tactile-Visual in which various generalizations can be seen as applying to two- or three-member sequences in this cycle. Visional and Auditory (V-A) verbs have separate structures in Japanese; V-A-O have properties associated to the fact that these are the distant senses, in which the perceiver can be separated in space from the percept; O-G are the chemical senses, poorly suited to making observations of events with complex temporal patterns: G-T are the contact senses; T-V are the controllable senses (the perceiver can decide what to look at or what to touch) and in some cases exhibit the grammar of verbs of action rather than verbs of experience, and so on.

A list of "frame elements" was offered for distinguishing the semantic roles of subjects and objects in perceiver-subject-perception verbs (*sounds angry, looks unhappy, tastes bitter, feels broken*, etc.). The paper was a report of the beginning phase of a contrastive study of verbs of perception across five languages (Danish, Dutch, English, French, Italian). The research group expects to tag concordance lines containing perception verbs taken from very large language corpora in each of these languages, to study differences in form, semantic structure, and text occurrence of different perception verbs, both in the same languages and across languages.

3.10   HANKS: **Meaning potentials: some suggestions for organizing semantic components so as to account for their variability**

I'll distribute a substantial selection of corpus evidence for a word that has been discussed by scholars, including some of those present. I propose "*climb*" (possibly also "*nod*" – both verbs in their main uses!). I have some suggestions about ways in which the various components of meaning are put together in a hierarchy to form one or more 'default interpretations', which together constitute the word's 'meaning potential' (not its 'meaning').

The evidence can be examined to investigate whether different meaning potentials

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are associated with different lexicosyntactic contexts (if this is true, it may be that ambiguities in word meaning are resolved by the context before they even arise).

I shall claim that on any given occasion when a word is used, each component of a default is either

1. activated;

2. quiescent; or

3. negated.

We can look at examples of each. We can ask whether rules can be formulated about what lexicosyntactic features of the co-text can negate semantic features of a verb.

We can look at noun uses of the same words and see how/whether the 'rules' for using a word ('exploiting its meaning potential') are different for nouns. If there is time, we could touch on an adjective, too.

We can also touch on the role of these mechanisms in metaphor and in meaning change.

3.11 INGRIA: **Standards for structuring the lexicon**

This talk gives an overview of the relation between computational considerations and the lexical semantics of contents of lexicons.

The talk begins with a historical overview of the relation between linguistic theory and computational lexical implementations of such theory. The rest of the talk will deal with specific areas in which lexical semantic information interacts with other modules of an NL system. Areas covered include the manner in which system architecture, system functionality, and application domain interact with the form and content of lexicons, the representation of the syntax and semantics of subcategorization, and the acquisition of lexical semantic information.

3.12 KAMP/ROSSDEUTSCHER: **Lexicon, Text Representation and Inference**

People demonstrate their understanding of a sentence, discourse or text primarily through their ability to draw inferences from it. Similarly, the semantic competence of an automated text understanding system manifests itself in the inferences it is able to draw from the representations it constructs.

It follows that a theory of semantic competence must show, at a minimum, how such inferences are possible. And the same demand must be placed on the theoretical foundations for any kind of software that can deal with non-trivial aspects of

sentence and discourse meaning. To do this it must articulate (a) what structures result from text and discourse interpretation and how these structures are systematically obtainable from the linguistic input which is directly available to the (hearing or reading) interpreter; and (b) how the structures resulting through interpretation can be exploited by formal inference mechanisms ("formal" in the sense that their operations are fully defined by the structural or "syntactic" features, without regard to their content) to yield the inferences that are accessible to the human interpreter.

Inferences from interpretational structures are not only important once the structure has been fully established. As a rule they are also needed in the course of constructing the interpretation itself. In fact, it is no exaggeration that the need for inferencing in natural language intepretation is ubiquitous.

It is important to add, though, that the inferences on which the intepretation process relies involve more often than not information from more than one of the sentences that constitute the interpreted discourse or text. Thus the importance, as well as the nature of interpretation supporting inferencing becomes clear only within the setting of a formal analysis of text semantics.

Even a summary investigation into the inferences needed during and after interpretation shows that lexical information plays a crucial part in this. A lexicon which accounts for the human ability to exploit such information must present its entries in a way which makes this information explicit and in such a form that it can be readily used in the inferences that depend on it; and the same goes for a lexicon suitable for incorporation into a text-understanding system.

In this talk we will give a number of examples of inferences, needed either during or after text interpetation, which depend on lexical information. We will make proposals for the form and content of a number of lexical entries, pertaining to the lexical items on whose meanings these inferences depend, and show in some detail how the inferencing mechanism we postulate can exploit these entries by importing their semantic information into the premise set on which the mechanism operates. Our sample entries will be chosen from the domain of "change of possession verbs" such as *sell*, *take*, etc.

Evidently the use of lexical information in the construction of interpetations is intimately related to the transition from syntactic to interpretational structures. Hence the widely recognized need to relate the forms of lexical entries closely to the problem of the syntax semantics interface generally. The nature of this connection between the lexicon and the syntax-semantics interface reveals itself in the computation of semantic structures from syntactic parses for the interpreted sentences, which must import the relevant information from the lexicon into the semantic representations it computes. Our illustrations of lexically based inference will throw light on this problem, too.

Change-of-possession verbs constitute a particularly systematic 'Verbfield' the members of which differ from each other in ways that allow for an analysis in terms of a

small number of virtually independent factors. A test for such an analysis (as for the semantic analysis of any lexical items!) is to see whether lexical entries based on the analysis will support the inferences that sentences in which these verbs occur enable the human interpreter to draw.

The present paper follows this strategy in that it uses lexical entries, constructed on the basis of the componential analysis just mentioned, for the verbs *ausleihen* and *ausrauben*, to construct semantic representations for short discourses containing these verbs and to derive certain consequences from them.

The representation construction uses the framework of DRT.

3.13 KLAVANS: **Linguistic Tests over Large Corpora: Aspectual Classes in the Lexicon**

The automatic acquisition of lexical knowledge from large corpora has dealt primarily with *occurrence* and *coocurrence* phenomena. The acquisition of complex and subtle inherent lexical features has not been attempted, since it requires a level of knowledge about structure, not just strings. A *methodology* is presented for obtaining semantic information on verb aspect by *parsing a corpus* and automatically *applying linguistic tests* with a set of structural analysis tools. Once applied, we propose a representation for verb aspect that associates a value with weights for event types. Weights reflect typical verb use, and thus represent a measure of the resistance or ease of coercion in sentential context.

The results we report here have been obtained in two ways: by extracting relevant information from the tagged Brown corpus (FRANCIS and KUČERA 1982), and by running a parser (McCORD 1980, 1990) on the Reader's Digest corpus combined with tools (KLAVANS and CHODOROW 1992) to extract more accurate information on verb usage in text. Comparisons between using a tagger and parser are made, showing how a representation of deeper structure is required for more sophisticated applications of linguistic tests over corpora.

Results will be encoded in the ESG lexicon, to be used to aid in translation of English to German texts. Current work and future plans for extensions are discussed.

3.14 KUNZE: **Structures of verb fields**

The relations between the internal structure of verbal sememes and the global structure of fields follow some general principles that various fields have in common. By a (verbal) field I mean a set of positions with certain structuring connections. Each position contains a prototypical meaning and a (syntactic) surface pattern. A verb belongs to a certain position if it has the corresponding meaning and realizes the pattern.

The following four positions form one core scheme in the field of the change-of-possession verbs in German:

etwas von jemanden annehmen	*etwas an jemanden abschicken*
"taking", [−Emph on SOURCE]	"giving", [−Emph on GOAL]
etwas jemandem wegnehmen	*etwas jemandem zuschicken*
"taking", [+Emph on SOURCE]	"giving", [+Emph on GOAL]

The feature "[+/−Emph]" is triggered by the prefixes, they distribute the semantic emphasis to one of the two propositions:

- *an−, ein−, er−, zu−, ...* (TO-prefixes) assign it to BEC (HAVE(q,u)), hence GOAL gets the emphasis if it is an actual role,

- *ab−, aus−, ent−, fort−, los−, ver−, weg−, ...* (FROM-prefixes) assign it (quite symmetrically) to BEC(NOT(HAVE(p,u))), hence SOURCE gets the emphasis if it is an actual role.

The basic semantic forms for these verbs are

CAUSE(ACT( ), ET(BEC(HAVE(q,u)), BEC(NOT(HAVE(p,u)))))

q		u		p		annehmen
q				p u		wegnehmen
P		q u				zuschicken
P		q		u		abschicken

The four lines show the combinations of actual roles and the distribution of sematic emphases (+Emph: underlined). SOURCE p and GOAL q appear as

- obligatory dative if they have an emphasis

- optional prepositional phrase (*von/an*) otherwise.

The active/passive-alternation does not affect this distinction, but it is connected with an emphasis on the ACT-proposition. AGENT (q or p) appears as

- obligatory nominative if it has an emphasis (active voice)

- optional prepositional phrase (*von, durch*) otherwise.

The argument u always has an emphasis and appears as structural case.

The field with its 90 positions in dual relationship is outlined.

Furthermore I deal with the verba dicendi as a second field. Here one finds another interesting phenomenon that could be called **argument conversion**. If UTTER(p,U) is taken as basic proposition, one may ask in which forms the utterance argument U

may appear as an actant. The verbs exhibit quite different possibilities for U to become an NP. It can be shown that these metamorphoses are connected with propositions which are contained in or may be added to the meaning of the verb:

Er zitierte: "Vom Eis befreit . . . "

> Er zitierte den Faust/aus dem Faust.

> Er zitierte Goethe/*aus Goethe.

The structure of this field resembles an irregular star with the verba dicendi proper (e. g. *sagen, sprechen*) in its centre and verbs with highly special meanings (e. g. *leugnen, überzeugen*) at the periphery.

3.15 LEVIN: **Clattering and clambering through the verb lexicon**

This paper presents a case study in lexical semantic analysis involving verbs of sound (e.g., *clatter, rumble, whir*) and, secondarily, verbs of manner of motion (e.g., *amble, run, walk*). Its aim is to support the hypothesis that the syntactic behaviour – and in particular the expression of arguments – of verbs is to a large extent semantically determined, in this instance in the face of some apparent challenges posed by verbs of sound and verbs of manner of motion. Specifically, the behaviour of these two types of verbs with respect to the resultative construction and the causative alternation appears to be in conflict with the semantic determination of their syntactic behaviour. This dilemma can be resolved by recognizing two related senses of these verbs, each associated with distinct syntactic behaviour. In addition, this case study brings out parallels between verbs of sound and verbs of manner of motion which provide insight into the structure of the English verb lexicon: there is a dichotomy in the lexicon between verbs that lexicalize a result and those that lexicalize a means or manner. Verbs of sound and verbs of manner of motion exemplify the second type of verb, explaining their shared properties.

3.16 MORREAU: **The Conditional Logic of Generalizations**

Generalizations are claims about what is generally or normally the case. **Kiwis normally live in the forest** is an example. And verbs (*walk, talk,* and so on) normally take the suffix "*ed*" for past participle formation. Characteristically, generalizations can be true in spite of there being exceptions: not all kiwis live in the forest. And there are a subclass of verbs – irregular ones, like *slept, wept* and so on – which normally take "*t*".

In the first part of the talk I will give an account of generalizations which is based on the modal conditional logic of LEWIS, STALNAKER and THOMASON. The idea is

that generalizations express what GOODMAN in "Fact, Fiction and Forecast" called "fainthearted" counterfactuals: they make claims about the properties individuals would have, were they to be normal representatives of whatever kind.

Generalizations lead to expectations about particular cases. Someone learning English, say, having understood the general rule, will guess that you are supposed to say "*negotiated*", even if he has never heard the word before. Thus far the theory doesn't explain this, since one consequence of their faintheartedness is that modus ponens doesn't hold for generalizations. This is as it should be, since reasoning from generalizations to particular cases must be defeasible: the learner of English might equally suppose the past participle of *creep* to be *creeped*, and here he needs putting right.

In the second part of the talk I will show how expectations about particular cases can defeasibly be derived from generalizations; such reasoning I see as a part not of the semantics of generalizations, but of their pragmatics. What I have to say here developed out of earlier work together with Nicholas ASHER on "Commonsense Entailment", and although the two accounts are not equivalent they surely have the same applications. This one is however more general and it is both conceptually and technically a lot simpler. I expect applications of Commonsense Entailment, described in the talks by ASHER, BRISCOE and LASCARIDES, will benefit from this.

The third part of the talk will be about another application relevant to Lexical Semantics: the analysis of causal relations. I will argue that LEWIS' counterfactual account is much improved on replacing his "closest worlds" counterfactuals by my fainthearted ones.

3.17 NIRENBURG: A "Society of Microtheories" Approach to Computational-Semantic Applications

A comprehensive study of computational treatment of text meaning is by nature multifaceted and covers a wide variety of language and language use phenomena. The various facets of this body of knowledge can become quite complex in their own right and their study could (and has in linguistic and computational-linguistic practice) been conducted in relative isolation from the study of other phenomena. It is not realistic to hope for the development of a single all-encompassing theory of computational semantics. However, high-quality applications require knowledge about a large number of language and language use phenomena. A natural way of combining this diverse knowledge into a single entity is to allow for the various phenomena to be treated by separate computational-linguisitic "microtheories" united through a system's control architecture and knowledge representation conventions. We perceive the following microtheories as central for the support of knowledge-based machine translation (and other high-demand applications):

1. microtheory of lexical-semantic dependency

2. microtheory of aspect

3. microtheory of time

4. microtheory of modality + additional speaker attitudes (including focus and speech acts)

5. microtheory of discourse relations

6. microtheory of reference

7. microtheory of style

8. microtheory of spatial description

The microtheory of semantic dependency is the locus of the study of the semantic behavior of open-class lexical items. We believe that there are two complementary stages (or components) of such a theory – syntax-driven and ontology driven lexical semantics. The former could be understood as a computational application of the lexical-semantic work in the tradition of FILLMORE, APRESYAN, B. LEVIN, S. ATKINS, N. OSTLER and others. The latter is an outgrowth of AI methods of studying natural language – the work of WILKS, SCHANK, CHARNIAK, LEHNERT, WILENSKY, CARBONELL and others and strives to overcome the well-documented scaling-up problems of this approach. We also pay attention to the notion of conventionality of meaning expression in a particular language, which is an accepted norm in practical translation but goes against the methodological principle of compositionality universally adopted by formal semanticists. This connects our work with the construction grammar of FILLMORE, P. KAY and others.

We are in the process of developing the above microtheory, both theoretically and in practice – by acquiring ontologies, lexical rules and individual lexicon entries in English, Spanish and Japanese. The "ancillary" microtheories we will adapt to our system requirements from a specification chosen from among a number of competing formal-semantic approaches to these phenomena. Due to the nature of the project, the adaptation of a flexible and powerful computational control architecture is essential. We are using a blackboard architecture system DIBBS developed at CMU.

3.18 NUNBERG: **Transfers of meaning**

In one form or another, the phenomena associated with "meaning transfer" have become central issues in a lot of recent work on semantics. Speaking very roughly, people have had four ways of approaching the phenomenon. In the first two, people have considered transfer in basically semantic or linguistic terms. Some have concentrated on what we might call the paradigmatic aspects of transfer, focussing on the productive lexical processes that map semantic features into features — for

example, the "grinding" rule that applies to turn the names of animals into mass terms denoting their meat or fur. This is the approach that's involved in most recent work on "regular polysemy," "systematic polysemy," and the like, for example by APRESJAN, OSTLER and ATKINS, BRISCOE and COPESTAKE, NUNBERG and ZAENEN, WILENSKY, and a number of other people. Other people have emphasized the syncategorematic aspects of transfer; that is, the ways meaning shifts and specifications are coerced in the course of semantic composition. This is an approach that's been developed in particular by James PUSTEJOVSKY and his collaborators, building on earlier work on type shifting.

As opposed to these, there are conceptual and pragmatic approaches to transfer which focus on the extralinguistic circumstances that license transfers of various types. Here again there are both paradigmatic and syncategorematic approaches, loosely speaking. The first is exemplified in a lot of recent work on metaphor by people associated with the "cognitive linguistics" school, which has focussed chiefly on the relations between domains of experience that metaphor variously exploits and imputes. The second is represented by work on indirect speech within Gricean pragmatics, relevance theory, and the like, which has been concerned with specifying the conversational conditions that give rise to metaphor, irony, and analogous phenomena.

Of course this categorization is a little factitious. The borders between these approaches are porous, and most work on transfer overlaps them. And this is entirely appropriate, since these are in no sense competing theories or accounts of the phenomena. Transfer is clearly a linguistic process, and in many of its most important forms a lexical one. But it just as clearly has its basis in very general cognitive and communicative principles. And while it's reasonable that people should choose to focus on one or another of these considerations relative to their immediate interests, it is also useful to keep the Big Picture in mind, lest we inadvertently ascribe to one domain of explanation a responsibility that more properly belongs to another. This is the picture I want to sketch out in this talk.

Speaking in a general way, a comprehensive account of transfer has to make appeal to three different kinds of regularities or rules. The first are nonlinguistic: the correspondences between domains, real or imputed, that transfer invokes, and the communicative interests that may make these invocations useful or instructive – they enable us to identify one thing in virtue of its relation to another, explain an abstract domain by reference to a concrete one, and so forth. Second, there is the repertory of general linguistic processes of transfer that exploit these correspondences and principles. By these I have in mind not traditional categories like metaphor, synechdoche, and metonymy, which are distinctions that have basically to do with the kinds of domain correspondences that transfer exploits, but the various types of operations that make possible type-shifting and sortal reassignment of expressions, syntactic recategorizations, and deferred indexical reference. These processes may cross-cut the domain correspondences that they exploit, and I'll show that we often find a single type of domain correspondence underlying two or more distinct semantic processes

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of transfer. Third, there are the language-specific instantiations of these operations, for example in the form of constructions or lexical rules that license particular types or subtypes of transfers (e.g., conversion via "grinding" of animal names into mass terms denoting their meat, a process allowed in English and many other familiar languages, but not in Greenlandic Eskimo.)

In the first part of this talk, I will illustrate this way of thinking about things by reference to the particular semantic operation of "predicate transfer," which licenses the sortal reassignment of expressions denoting properties and relations, and which underlies a great deal of lexical polysemy. The process I have in mind is illustrated by an example like "I am parked out back." This is usually regarded as a classic instance of metonymy – i.e., "person" for "car" – where we use an expression that would conventionally denote one thing to refer to some other thing to which it is connected by a "relation of contiguity." But I'll show that on consideration there are compelling reasons for supposing that *I* here refers to the speaker, rather than his car. (For one thing the number of the pronoun doesn't vary according to the number of cars involved: if you had two cars parked out back you wouldn't say "We are parked out back," though of course this would be the appropriate thing to say to refer to a single car owned by two or more people). And other morphological and syntactic observations support the same conclusion: in examples like this what has been transferred is the meaning of the predicate, rather than its argument. That is, the predicate *parked out back* has a transferred reading here: it denotes the property that the speaker acquires in virtue of his relation to a car that has the property of being parked out back.

Two conditions have to be satisfied before predicate transfers like this one are licensed. First, there has to be a salient correspondence (more specifically, an injective function) between the properties of things in one domain and the properties of things in another; e.g., between the locations of cars in a lot and the properties that distinguish the owner of one car from the owner of another. Second, it has to be either useful or interesting to know that these acquired or inherited properties apply to their carriers: that's why we can say "I am parked out back" to someone who is about to go get the car, whereas it is hard to imagine a context in which one would want to say "I was once driven by Ricardo Montalban."

I will give a simple formal account of these conditions on predicate transfer, and then show how it resolves some familiar syntactic and semantic difficulties. Take Jackendoff's example "Ringo squeezed himself into a narrow parking space." If we analyze this as involving a metonymy, we will have to say that the reflexive here denotes something distinct from its antecedent, and so make provision for certain sortal shifts in giving the identity conditions on reflexivization and other rules and constructions ordinarily require coreference of pronoun and antecedent. Whereas now we will take *squeeze into a narrow parking place* as a transferred predicate that denotes a relation between persons: in virtue of having squeezed his car into a space, that is, Ringo has also done something noteworthy to himself. More generally, I'll

argue that the conditions on rules of anaphora and similar operations never make provision for sortal shifts; sortally speaking, we must always take "syntactic identity" in the strictest possible way.

In the second part of this paper, I'll talk about the way predicate transfer is instantiated in systematic polysemy. I'll mention several familiar cases: grinding, conversion of names of artists to the names of their works (e.g., *a Picasso, an Agatha Christie*, and the use of the names of publications like *newspaper* and *magazine* for the organizations that produce them. Each of these processes is subject to a variety of constraints, which may answer any of several different principles. Some are due to the absence of perceived domain correspondences of the appropriate type (for example, the failure of words like *mammal* and *bird* to undergo grinding. Some are explained by the fact that the acquired property denoted by the transferred predicate is insufficiently noteworthy or criterial: that is why we don't say *She was reading a Kafka*. Still others are due to the absence of specific lexical licenses for certain types of transfer; this explains why we don't generally use the "artist for work" rule to derive the names of musical works (*?two Beethovens, ?several Elvises*), or why grinding does not apply in English to derive the names of liquids *?We always cook with olive.* All of this by way of showing why it is important to bear in mind the heterogeneity of the mechanisms that underlie transfers of all types.

3.19 PUSTEJOVSKY: **Semantic types and degrees of polymorphism**

In the talk, I investigate how best to characterize the formal mechanisms necessary for explaining the behaviour of logical polysemy. In particular, I discuss an approach which aims at describing natural languages in terms of "degrees of polymorphism". I argue that it is necessary to study the range of polymorphism behaviour in order to characterize the semantic expressiveness found in natural languages. After reviewing the class of monomorphic languages, I will demonstrate that systematic polymorphism is a widespread property of natural language and must be accounted for by a semantic framework. I suggest that the general mechanisms of type coercion, operating within the generative lexicon framework, is able to capture polymorphic behaviour, when specific constraints on the application of coercion are imposed. I will examine the nature of these constraints and what consequences they have for semantic theory.

3.20 WEIGAND: **An object-oriented lexicon based on Functional Grammar**

In Functional Grammar (DIK 1978, 1989) the Lexicon is a central part in the grammar. It contains the basic predicate frames from which the underlying clause, or

predication, is composed. A predicate frame is a unit of semantic, morphosyntactic and pragmatic information concerning the lexeme. Meaning definitions are supposed to be specified not in abstract semantic features but in terms of other predicate frames (Stepwise Lexical Decomposition).

In (WEIGAND 1989) the FG Lexicon was couched in an f-structure style, and the Lexicon was built as a hierarchical structure with inheritance of semantic information. The semantic information includes the semantic functions ("deep cases") and their selection restrictions, pre- and postconditions (for dynamic SoAs) as well as some other features. In this talk I want to extend the hierarchical lexicon to an object-oriented framework with multiple hierarchies, methods, default inheritance and a managable form of default or defeasible logic. This work was done in cooperation with Walter DAELEMANS.

It is argued that Dik's method of Stepwise Lexical Decomposition has a natural formal equivalent in the semantic inheritance structure. While basic concepts at the top of the structure are defined by means of pre- and postconditions, the concepts lower in the tree are defined primarily by multiple subclassification. Non-prototypical senses are represented as projections from the prototypical sense on a subset of the multiple classifications.

3.21 WUNDERLICH: **CAUSE and the structure of resultatives**

1. Inherent causative verbs are decomposed into predicate templates such as $CAUSE(x, BECOME(Py))$ or $CAUSE(x, BECOME(Ryz))$.

   I consider these structures as the fine-grained contribution of verbs to Logical Form. Under the grammatical respect, lexical decomposition of verbs should make visible the argument hierarchy of verbs.

2. Argument hierarchy is matched with the grammatical features of complements (morphological case, agreement, syntactic position) by means of two principles:

   - the hierarchy principle,
   - the linking principle (BIERWISCH, KIPARSKY, WUNDERLICH).

   These principles make predictions about argument linking which in many cases turned out to be correct.

3. Many verbs allow for a resultative extension ("*They run the lawn flat*", "*He ate the plate empty*"). In order to represent this extension, two versions are considered:

   - $RUN(x)(s) \rightarrow [RUN(x)(s) \& CAUSE(s, BECOME(Py))]$
   - $RUN(x)(s) \rightarrow [RUN(x)(s) \& BECOME(Py)(s)]$

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It will be shown that the distribution of arguments in resultatives can be correctly predicted, and that there cannot be a resultative morpheme, for principled reasons.

In German, strict transitve verbs as well as ergative verbs cannot undergo the resultative extension, but both classes of verbs can do so in English. This difference will be discussed.

A final remark: How far and under what aspects is causation grammaticalized?

4 Round table discussion: organizing the preparation of lexical resources

For each of the following topics, we ask some questions and give a few general comments pointing to more detailed questions, possible solutions, or simply to pieces of background knowledge on which the round table participants may usefully comment.

1. The interaction of lexical work with other research and development work in NLP/Speech:

   - should lexical issues be treated separately or as a part of projects on specific NLP tasks and applications?

   It has been argued that, since the 1980s, a sort of "do-it-yourself-mentality" has been observable in NLP work, where every project on Machine Translation, on NL database query or information retrieval, or on other aspects of NLP created its own lexicon; these lexicons were in general highly geared towards the application they were bound to, but often also very detailed in their contents. Most of them were rather small in coverage; but since there is a number of such dictionaries, there is also a considerable amount of expertise in the field of lexical description and dictionary construction spread over the numerous projects.

   Ways to continue work in the lexical resources area could consist in setting up joint activities of several institutions aiming exclusively at the construction of lexical resources for a range of applications, but also in a continuation of the current organizational model which is more of an integration of lexical work as one strand of activities into other research activities, such as e.g. MT, NL database query, etc.

   Other options may be to concentrate on certain levels of linguistic description, in particular on semantics, and to try and come up with lexical work for larger fragments in the framework of general approaches to computational semantics.

   In Europe, given the diversity of national languages, different tasks may be accomplished by national and by supranational bodies. E.g. work on individual languages will most probably be more bound to national actions, whereas horizontal activities, such as standardization, guidelines for common methodologies and approaches, are more an area for supranational action. Worldwide collaboration, e.g. between Europe and the USA, might usefully be subsumed under the horizontal actions.

2. Implications of lexical work on the architecture of NLP and speech systems, and their impact on the organization and structure of projects:

- what is the role of linguistic resources (and lexicons in particular) for NLP and Speech system architecture and how does this role affect the organization of these projects?

If we accept the claim that linguistic resources (grammars, lexicons, etc.) are central for any NLP system, we may conclude from this that much effort should go into work on the structure and organization of such resources.

Two problems are connected with this assumption: one is the feasibility of multifunctional lexical resources which can be modules of more than one application, the other concerns the relationship between dictionary structure and dictionary construction methodology.

Recently, some work has been invested into research on multi-purpose dictionaries. On the side of practical lexicography, the distinction between a general lexical stock and "front-end dictionaries" extracted from these according to the needs of certain user groups has been made, and to some extent publishers use their lexical resources to produce dictionaries of different types. In NLP, claims of this type have been made by GENELEX and within the EUROTRA-7 Study; the MULTILEX ESPRIT project is currently working on an approach to the creation of multi-purpose dictionaries. Is this area mature for exploitation at a larger level, or are more studies and small-scale experiments necessary to assess the feasibility of the approaches proposed? For lexical semantics, definitely the latter seems to be the case. But what are ways and means of getting one step further, in this area?

As has been recognized in the area of grammars, lexicon building and maintenance poses problems of collaborative working methodology. In practical lexicography, in publishing houses, it is customary to produce dictionaries with teams of several dozen collaborators. This is less customary in NLP, and so far, many dictionary systems do not allow for such an approach. Do we need an "engineering" approach to lexicon construction, enhancement and maintenance, and if yes, what are ways of enforcing it, from the point of view of research agencies?

3. Plans, expectations, changes of success of joint international efforts in the lexical area:

   - given the size of the task, are there synergies to be expected from collaborative work in the lexical field? Which concrete form may such collaborative actions take? Is there room for transatlantic activities in the field?

A number of collaborative efforts in the field of NL and Speech engineering have been undertaken or started recently.

At the European level, the EAGLES initiative (Expert Advisory Group on Linguistic Engineering Standards) is an example of recent date. This expert group,

composed out of members from both industry and academia, will survey current practice in lexical description, corpus building, linguistic formalisms, spoken language processing and in the evaluation of NL systems and will come up, for each of these areas, with recommendations concerning commonly acceptable de facto standards for practical work in these areas.

Transatlantic and worldwide cooperation schemes are also in the process of being installed or are already in place. At the level of interaction between projects, exchange between ESPRIT and DARPA activities (such as between ACQUILEX and the LDC) has started. Similarly, the CEC and US administration made it possible for European teams working in basic information science and technology research areas currently supported by ESPRIT to form closer links with teams funded by the US National Science Foundation who work in closely related areas.

In the Speech processing community, the COCOSDA initiative (Coordinating Committee on Speech Databases and Speech I/O Systems Assessment) has developed over the last ten years, out of a series of satellite events of conferences, an electronic bulletin board, etc. into a standing committee for speech databases, with its own work groups, projects, etc.

For the lexicon and semantics area, international cooperation is crucial, as is cooperation of different scientific fields.

Which of the formulas of cooperation have proven successful so far, and which type of cooperative activity would be most useful to promote lexical work?

9313 Universals in the Lexicon

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