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In this period, the Institute has been active in building and supporting linguistic corpora. In addition to the CELEX project described under 12.2, Pim Levelt initiated a large project, supported by the Dutch and Flemish governments, for a Corpus of Spoken Dutch, and Wolfgang Klein initiated, under the auspices of the *Berlin-Brandenburgische Akademie der Wissenschaften*, a major project to build a modern German dictionary based on an extensive corpus of written and spoken German. The ESF corpus of second-language acquisition has, under the initiative of Wolfgang Klein, been integrated into the MED system ('Spoken Childes') which allows direct access from the text to the speech and speechwave. The most extensive child-language 'input' corpus to date was collected by Joost van de Weijer in the Comprehension group, as the basis of a dissertation. A corpus of linguistic materials is being assembled on the more 'exotic' languages under investigation by the Language & Cognition group (many of them endangered, and thus important to document). The Technical Group has supported all this with the development of major new tools for linguistic computing and multi-media corpora (see 12.1.5).

Finally, our *Fachbeirat* or Scientific Council has come to the end of its six-year term of office (the names of the Council are listed on the following pages). We take the opportunity to thank them deeply for their firm constructive criticism, which has helped to guide the Institute over that whole period.

We hope this report proves useful to you - naturally not everything can be reported here, and further information and addresses are available on the web pages of the Institute: <http://www.mpi.nl>.

Stephen C. Levinson

Organization of the institute in 1998

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PROJECT DESCRIPTIONS

1 PHONOLOGICAL STRUCTURE IN COMPREHENSION

The Phonological Structure in Comprehension project investigates the ways in which the processing of spoken language input is constrained by the phonological structure of the input language. Research during the past year addressed infants' acquisition of native phonology, as well as the role of phonological structure in the processing of segmental structure, in word recognition, and in the comprehension of continuous speech. The research further involved studies both of native-language processing and of the effect of native-language phonology on the processing of a non-native language.

1.1 Development of phonological structure perception

Acquisition work on this project in 1998 consisted of Van de Weijer's Ph.D. project (1.1.1), which has now resulted in a dissertation, along with further studies of infants' abilities to recognize words in speech contexts (1.1.2), and initial work on test material for assessment of developmental dyslexia (1.1.3).

1.1.1 Speech input to a prelinguistic infant

Van de Weijer completed his dissertation, which describes analyses of the corpus of linguistic input to a prelinguistic infant collected in 1994 (see Annual Reports 1995, 1996, 1997). The analyses cover all the language which the infant heard during 18 days, selected from the period when the infant was between six and nine months old: some 85,000 utterances in total. The dissertation includes analyses of the amount of input heard by the infant, broken down into specifically infant-directed input versus overheard speech between adults, or between adults and other children

(see Annual Report 1995); comparisons of structural characteristics of the infant-directed versus adult-directed speech, for instance with regard to utterance length, type-token ratio, syntactic characteristics and phonological correlates of word-boundary location (see Annual Reports 1995, 1996 and 1997); prosodic comparisons of infant-directed speech, adult-directed speech and speech addressed to other children, covering speech rate, intonational patterning and pitch characteristics (see Annual Reports 1996 and 1997); and experimental tests of a computational model of vocabulary acquisition (see Annual Report 1996). Final analyses conducted since the last Annual Report showed that the infant-directed speech contained significantly fewer embedded words than did the adult-directed speech in the corpus, presenting fewer opportunities for ambiguous lexical segmentation.

Although the proportion of linguistic input which was directly addressed to the infant was relatively small, Van de Weijer's dissertation concludes that this specifically infant-directed speech did display a number of characteristics which could facilitate early vocabulary building.

1.1.2 Infants' word recognition in fluent speech

Head-turning experiments with 9-month-old Dutch infants carried out by Kuijpers, Coolen and Cutler (in collaboration with Jusczyk and Houston, Johns Hopkins U., Baltimore), and reported in the Annual Report of 1996, showed that these infants performed significantly better than 7.5-month-olds from the same population in recognizing in a continuous-speech context bisyllabic words with a strong-weak stress pattern (e.g. *boksei*) after they had been familiarized with the same words in isolation. In a follow-up study by the same group of collaborators, 9-month-old English-learning infants in Baltimore were presented with the Dutch materials. As in the original study, the infants were familiarized with pairs of words and then tested on four passages, two of which included the familiarized words while the other two did not. The English-learning infants gave evidence of segmenting the targets from the passages to an equivalent degree to the Dutch infants. Dutch and English have similar rhythmic structure and hence encourage similar segmentation procedures; the results thus suggest that early word segmentation strategies may be sufficiently general to apply to other languages with a similar rhythmic organization to the native language, even when the languages differ in phonetic structure.

1.1.3 Perceptual problems in developmental dyslexia

Schwippert (U. of Amsterdam) completed her final undergraduate project in the Phonological Structure in Comprehension group during 1998, under the supervision of Kuijpers. The research, which formed part of a national Dutch research project aimed at identifying the core features of developmental dyslexia, aimed to assess auditory test material newly developed for use with both child and adult listeners. Three speech continua [bak-dak, bak-zak, bak-wak] were constructed by interpolation from naturally-spoken endpoints and these stimuli were validated in perceptual discrimination and classification tests with a group of dyslexic adults and a matched group of normal control subjects. Note that all continuum endpoints are real Dutch words which can be pictorially represented (*bak* 'shallow container', *dak* 'roof', *zak* 'bag', *wak* 'hole in the ice'), so that no reading ability is required at any point in testing. In both types of test, dyslexic subjects performed significantly worse than controls, especially in the speed of their reactions; these results confirm the choice of procedure and materials for this project.

1.2 The role of phonological structure in segmental processing

Studies of segmental processing on this project during 1998 included the Ph.D. research of Weber investigating the effects of violation of native-language phonological rules on the perception of foreign-language input; initial studies described in 1.2.1 led to the discovery of a processing asymmetry between regressive and progressive assimilation. Further work addressed the viability of perceptual explanations of vowel inventory patterns (1.2.2).

1.2.1 Regressive versus progressive assimilation

Weber's Ph.D. project investigates effects of violation of assimilation on perception of native- and foreign-language input. Earlier studies (see Annual Reports 1996 and 1997) showed that violation of obligatory assimilation rules adversely affects phonemic processing. Two experiments were designed to replicate this effect for non-native listening, using Dutch and German. The distribution of the velar fricative [x] after back vowels (as in *lacht*, 'laughs') and the palatal fricative [ç] after front vowels (*Licht*, 'light') in German provided the phonological background. The Dutch phoneme repertoire only contains the velar fricative [x].

In separate experiments, German and Dutch listeners detected the fricative [x] in monosyllabic Dutch nonwords. For German listeners half of the nonwords contained violation of the German fricative assimilation, in that the velar fricative was preceded by a front vowel. Whereas Dutch listeners presented with the stimuli showed no response differences as a function of the vowel, German listeners detected the fricative faster when assimilation was violated, instead of, as expected, more slowly.

A third experiment, using the same assimilation rule, investigated whether the observed facilitation effect was dependent on non-native listening or on the syllabic structure of the environment (the previous experiments used only cross-syllable environments). Again, German listeners presented with German nonwords detected the fricative [x] faster when a violation occurred, regardless of syllable membership and the fact that the stimuli were native nonwords.

Finally, since German fricative assimilation is progressive (an earlier sound affects a later one) whereas previous studies had tested regressive assimilation (a later sound affects an earlier one), a further experiment tested regressive assimilation for nasals in German. Nasals must match the place of articulation of a following velar stop. Indeed, German listeners detected stops more slowly when regressive place assimilation for nasals was violated. The results indicate that violations of regressive versus progressive assimilation differ in how they affect segmental processing.

1.2.2 Perceptual factors in universals of vowel inventories

A gating study by Warner addressed the question of whether the distinctions most commonly used in the world's languages are those distinctions which listeners are able to perceive during a brief portion of the speech signal (20-40 msec). This hypothesis was initially proposed by Stevens and some support for it was found in gating studies of American English vowels by Lang and Ohala. Warner's experiment used the same task to determine which of the distinctive features of the Dutch vowels listeners are able to perceive rapidly and which require a longer portion of the signal to become clear. Dutch is a particularly good language in which to carry out this investigation, since it uses both cross-linguistically common and less common distinctive features in its vowel system.

The results supported the hypothesis for some features. The long/short distinction (as in *tak* versus *taak*) and the four-way height distinction (exemplified in *Piet*, *pit*, *pet*, *pat*) are both cross-linguistically less common

than a three-way height distinction or a front/back distinction, and, in accord with the hypothesis, both were not perceived unless listeners were allowed to hear a long portion of the signal. However, rounding of front vowels (as in *u*), also a relatively uncommon distinction, was perceived accurately even from very short portions of the signal, counter to the hypothesis. Front rounding was in fact perceived more quickly than the far more common high/mid distinction (e.g. *zie/zee*). Thus, rapid perceptibility is only one of the perceptual factors involved in determining phoneme inventories.

1.3 Phonological structure in word recognition

Studies of lexical activation and processing in this project in 1998 included the new Ph.D. project of Cooper (1.3.1), in which initial research addressed the role of lexical stress in lexical activation in non-native listening; cross-language studies of the role of vowels versus consonants in lexical activation (1.3.2); and further studies of the role of Dutch vowel epenthesis in word recognition (1.3.3).

1.3.1 Prosodic structure in word recognition in a non-native language

Previous studies (see Annual Reports 1996 and 1997) have shown that Dutch listeners can use lexical stress cues to constrain the activation of words in their native language, whereas English listeners do not. Using both the fragment priming and gating tasks, Cooper investigated whether Dutch listeners use lexical stress information to constrain word recognition in English.

Twenty-one pairs of English words, such as *MUSIC* and *MUSEUM*, were found. These pairs have a segmentally identical, unreduced first syllable and following phoneme, but different stress patterns. In the fragment priming task, participants made visual lexical decisions to one of the target words (e.g. *museum*) presented immediately following spoken presentation of a neutral sentence ending with a word fragment. The fragment was either (1) the segmentally identical section from the other word in the pair (e.g. *MILS-*: incorrect stress); (2) the same section from the target word itself (e.g. *MUS-*: correct stress); or (3) a control fragment (e.g. *MONS-*). The neutral carrier sentence provided a baseline for processing stress information in the fragment. Responses after fragments with the same segmental information as the target (e.g. either *MUS-* or *MUS-*) were significantly faster than after the control fragments and responses after fragments with correct stress matches were significantly faster than after

fragments with incorrect stress matches. Dutch listeners used both segmental and stress information to boost recognition of the appropriate word.

The same materials were used in a gating study, where participants heard the carrier sentence ending in ever-increasing portions of the target word. Fragments increased by one phoneme at a time and, after each presentation, listeners guessed what word they thought the fragment came from. In this study, participants tended to make monosyllabic responses; any bisyllabic responses had a first-syllable stress bias. However as fragments increased in size, participants did produce more responses with stress patterns that were consistent with the input. In collaboration with Wales (U. of Melbourne), the same experiments are currently being run with native speakers of English, to compare Dutch and English listeners' use of stress information in word recognition.

1.3.2 Cross-linguistic differences in constraints of vowels versus consonants on lexical activation

Languages differ in the constitution of their phonemic repertoire and in the patterning of phonemes in word forms. Cutler, in collaboration with Sebastian (U. of Barcelona), Soler (U. Autònoma, Barcelona) and Van Ooijen (CNRS, Paris), carried out two word reconstruction experiments to investigate whether such differences constrain the activation of spoken words. In word reconstruction, listeners turn nonwords (e.g. *kebra*) into real words by changing single sounds (thus *kebra* could be changed into *cobra* or *zebra*). Dutch listeners responded significantly faster and more accurately when required to change vowels as opposed to consonants; when allowed to change any phoneme, they more often altered vowels than consonants, and vowel responses were made more rapidly than consonant responses. For these listeners, vowel information thus appears to constrain lexical activation less tightly (allow more potential candidates) than consonant information. This result from Dutch also replicates results earlier found by Van Ooijen in English. Subsequent studies with Spanish subjects again produced a similar pattern of results.

Vowels and consonants may differ in their potential for excluding lexical neighbors. In all languages for which such lexical statistics have been computed, and certainly in English, Dutch, and Spanish, existing words can be transformed into other existing words about twice as often by changing a consonant as by changing a vowel (e.g. *brain* → *crane*, *train*,

break, brave, brine, bran etc.). Thus, listeners run more risk of erroneously activating the wrong word if consonants are misperceived than if vowels are misperceived. Vowel information may therefore constrain activation less tightly and be more readily altered in the word reconstruction task. Alternatively, vowels may exercise less constraint because they are more variable in real-speech contexts than consonants are; in consequence, listeners may treat consonantal information as more reliable.

1.3.3 Vowel epenthesis in Dutch

Earlier lexical decision and word-spotting studies by Cutler, Van Donselaar and Kuijpers (see Annual Reports 1995 and 1996) showed that Dutch words realized with an epenthetic schwa breaking up a syllable-final consonant cluster (e.g. *tulap* instead of *tulp*) were easier to recognize than the same words in their canonical form without the epenthetic vowel. A phoneme-monitoring experiment, using materials from the earlier studies, showed that detection of the first consonant in such a cluster was also faster in the forms with epenthesis than in the realizations without. This result suggests that the facilitatory effect of vowel epenthesis arises because liquid consonants are easier to perceive in prevocalic than in preconsonantal position, so that insertion of a vowel renders an otherwise difficult segment more perceptible.

1.4 Phonological structure and the recognition of continuous speech

This section of work in the Phonological Structure in Comprehension Project included electrophysiological studies by Van Berkum, in collaboration with the Neurocognition Project, examining the syntactic processing of spoken sentences; these are described in the Neurocognition Project chapter. Further studies investigated mora timing in a corpus of Japanese spontaneous speech (1.4.1), and, in collaboration with the Spoken Word Recognition project, the nature of the Possible-Word Constraint (1.4.2).

1.4.1 Japanese mora timing in spontaneous connected speech

Japanese is frequently claimed to be a mora-timed language; there is a considerable experimental literature both in favor of and against various versions of the mora-timing hypothesis. However, almost all previous studies use extremely careful laboratory speech, often nonsense words in strong focus position. In collaboration with Arai (Sophia U., Tokyo), Warner

analyzed a corpus of spontaneous, conversational Japanese speech to determine whether any type of mora regularity exists in more natural Japanese speech.

Most of the previous literature on Japanese mora timing attempts to show temporal compensation between neighboring segments or moras, making up for durational differences introduced by segmental differences. A naturally produced corpus rules out this method. Instead, the analyses focused on the degree to which the duration of a word or a part of the word can be predicted by the number of moras the word contains. The results showed that word duration depends far less on number of moras in spontaneous speech than in careful speech. Furthermore, a variety of statistical analyses revealed effects which are directly counter to both the word-level mora timing hypothesis of Port et al. and earlier, simpler versions of mora timing.

Previous experiments by Cutler and Otake have shown that the mora plays a role in the processing of Japanese speech. The mora is also clearly relevant in Japanese phonology. However, this does not mean that durational compensation takes place over the mora or any other unit in Japanese speech. Because Cutler and Otake propose that the importance of the mora for listeners' processing of Japanese is rooted in Japanese having a mora-based rhythm, it is important to understand what constitutes this rhythm. Following work of Dauer, it is proposed that the mora rhythm of Japanese relates not to durational compensation but to the combination of several phonological and phonetic factors (such as restricted syllable structure, the pitch accent system, etc.). Thus the situation in Japanese is analogous to the situation in stress-timed languages such as English and Dutch, in which stress rhythm plays a role in processing but strict durational regularity of such units does not obtain. The present study furthers the phonetic debate on mora timing by investigating far more natural speech than has been studied before, and also adds to our understanding of the factors which determine a language's rhythm.

1.4.2 The Possible Word Constraint and language-specific word structure

The Possible Word Constraint (PWC) in the segmentation of continuous speech inhibits activation of word candidates if accepting them would leave a residue of the speech signal which could not be a word. Thus

apple is harder to spot in *fapple* than in *vuffapple* because [f] is an impossible word. Previous studies (see Annual Report 1997) suggested that the constraint operates in a universal manner across languages. New studies in 1998 further explored the PWC's operation.

McQueen and Cutler, in collaboration with Otake (Dokkyo U., Soka, Japan), examined the effects on speech segmentation of vowel devoicing in Japanese. High vowels (/u/ and /i/) can be devoiced when preceded and followed by voiceless obstruents (*matsu kara*, 'from a pine tree', spoken as [matskara]), or utterance finally, when preceded by a voiceless obstruent (*ohayogozaimasu*, 'good morning', usually ends with an [s], but no [u]). The devoicing process is not simple deletion of the vowel; the neighboring segments (such as the [s] in *ohayogozaimasu*) show compensatory lengthening. This process raises an interesting question about the operation of the PWC: does a single consonant in a possible devoicing environment count as a possible word (because it could stand for an underlying syllable), or not? Subjects tried to spot words with three types of following context: a vowel (i.e. a possible word, e.g. *matsu*, 'pine tree', in *matsua*); a consonant which could have a following devoiced vowel (*matsush*, which underlyingly could be *matsushu*); and a consonant which could not have a following devoiced vowel (*matsua*). Performance was equivalent in the two consonantal contexts, and significantly worse than in the vocalic context. This pattern of results was observed in three different word-spotting experiments: in all cases, subjects found it as hard to spot words when the contexts contained consonants which permitted devoiced vowels as when devoiced vowels were not permitted. The PWC appears to operate on the basis of the acoustic-phonetic information which the listener hears (whether an isolated consonant, and thus an impossible word, is part of that input) and not on the basis of phonological knowledge which would indicate that some consonants are potentially residual syllables (and thus possible words).

Together with Pallier (CNRS, Paris), McQueen and Cutler also continued investigation of the PWC in French. Earlier studies (see Annual Report 1997) had established that word-spotting in French was inhibited by single-consonant contexts (e.g. *flire* for *lire*), including contexts that were established by phonotactic grouping constraints (*camOlire*, which must have a syllable boundary at #), while CVC contexts (*caflire*) did not inhibit word-spotting. Follow-up studies in 1998 confirmed these findings, adding CV as a possible-word context (*calire*) and showing that phonotactic

constraints, and not simply number of consonants in sequence, produce a single-consonant context (*lire* is easier to spot in *carflire* than in *cam#flire*).

Further studies of the PWC's operation were carried out in Dutch. Cutler and McQueen compared the relative effect on a word's activation of consonantal contexts which could or could not be integrated into the syllable structure of the word; for instance, how easy is it to detect *rok* 'skirt' in *mrok* versus *prok*? The sequence [pr] could be a syllable onset, but [mr] cannot occur within a syllable in Dutch, and McQueen's previous work (see Annual Report 1995) showed that listeners apply knowledge of this constraint to speech segmentation. In the latest experiments, Dutch listeners' word-spotting performance showed a clear possible-word effect: *rok* was much harder to detect in the impossible-word contexts *mrok* and *prok* than in the possible-word contexts *fierrok* and *fieprok*. However, there was also an effect of the syllabic boundary information, in that the difference between *prok* and *fieprok* was significantly larger than that between *mrok* and *fierrok*. Thus, an impossible-word context inhibits activation of an adjacent word even when phonotactic information about syllable structure is available to inform listeners that there is a likely word boundary between the word and its context. When there is no such boundary cue available, i.e. the context can be integrated into the syllable structure of the word, the inhibition effect is even greater.

Another word-spotting study compared impossible-word contexts with three types of possible-word contexts: syllables with full vowels, syllables with reduced vowels, and bisyllables; this study also varied the syntactic category of the embedded words (comparing for instance *lepel* 'spoon' with *wonen* 'to live', since many experiments have used only noun targets), as well as stress pattern of the embedded words (*lepel* versus *recept* 'prescription', since it has been claimed that trochees are easier to recognize than iambs). This experiment again produced a large inhibitory effect of impossible-word contexts: listeners were significantly slower and less accurate in spotting words in consonantal contexts than in any of the other three types of context. The three possible-word contexts did not differ, however; this result replicates earlier findings from Sesotho and English (Annual Report 1997). Although responses were somewhat slower and less accurate to verb targets than to noun targets, these differences were not reliable; furthermore, the impossible-context effect was equivalent for nouns and verbs. These results thus suggest that nouns and verbs are recognized via the same processes, and that non-noun

target words can be used in the word-spotting task. There was no overall difference between trochaic and iambic target words; this suggests that trochaic words are not in principle easier to recognize than iambic ones.

Finally, McQueen, Otake and Cutler further examined the status of moraic nasals in word segmentation in Japanese (see Annual Report 1996). A moraic nasal, like other consonants, is not a possible Japanese word: spotting *matsu* could thus be as hard in *matsuN* as in *matsud*, where the single [d] is an impossible word. On the other hand, there is a moraic boundary, and thus a likely word boundary, between the [u] and the *HI* in *matsuN*: spotting *matsu* could thus be as easy in *matsuN* as in *matsua*, where there is a mora boundary between the [u] and the [a] (and the final vowel is a possible word). A series of word-spotting and control lexical-decision experiments examined these predictions. It was once again found that word-spotting was reliably harder in the context of an impossible word (a single consonant such as [d]) than in a possible-word context (a vowel). Spotting words in moraic nasal contexts, however, was as easy as in the vocalic contexts. It appears therefore that in Japanese a mora boundary is sufficient to cue a likely word boundary whether the following context is a possible word or not, and this in turn suggests that the relative strength of boundary cues versus the PWC may vary across languages.

2 SPOKEN WORD RECOGNITION

How do listeners recognize spoken words? Over the last five years, research within this project has shown that word recognition is based on a process of competition between candidate words, as instantiated in the Shortlist model (see Annual Reports 1994-1997). Research in 1998 examined how this competition process is affected either when the speech signal contains mismatching acoustic-phonetic information (2.1.1), or when words are embedded within other words (2.1.2). Phonological priming experiments also examined the lexical access process (2.1.3).

Competition offers a mechanism not only for word recognition but also for segmentation of continuous speech into words. As was argued in previous Annual Reports, competition-based segmentation is enriched through the use of cues to likely word-boundary locations (including transitional probabilities between phonemes, 2.2.1) and the use of knowledge about the viability of sound sequences as possible words in a language (the Possible Word Constraint, PWC). Cross-linguistic work on the PWC continued in 1998 in collaboration with the Phonological Structure in Comprehension project, and is reported in 1.4.2. Another important question about the PWC concerns the role of morphology in segmentation; research this year asked whether consonants which are morphological suffixes pass or fail the constraint (2.2.2).

Shortlist has an autonomous architecture: information flows from lower levels up to the lexical level, but not top-down. This claim has been tested both in 1998 and earlier with experiments which require listeners to make phonemic decisions. Work therefore continued on the development of the Merge model (see Annual Report 1997), an autonomous model of phonemic decision-making which shares with Shortlist all core

assumptions about word recognition. The Merge model accounts for the available data on lexical involvement in phonemic decision-making. New research explores the time-course of these lexical effects (2.3.1). Other work on phonemic decision-making examines the influence of sentential context on categorization decisions (2.3.2) and the extent to which a decision about one phoneme is dependent on decisions made to neighboring phonemes (2.3.3).

2.1 Lexical access in a competition model

2.1.1 Segmental mismatch

Van der Lugt collected data on the tolerance of the word recognition system to mismatching information. Following up on previous research on the effects of initial consonantal mismatches (see Annual Report 1997), a second set of word-spotting and identity priming experiments examined the effects of later-occurring consonantal mismatches. Will *hambuj* activate the longer word *hamburger* to the same extent as the word onset *hambur* (because the final [j] mismatches minimally with the [r]), or will it pattern with *hambup* (with a larger final mismatch)? Overall, the results showed that the word recognition system is rather intolerant of phonetic mismatches. They suggest however that mismatch is tolerated more when a segment of an utterance mismatches a candidate word by a single feature than when it differs by several features.

Cutler, in collaboration with Van Ooijen (CNRS, Paris) and Norris (MRC Cognition and Brain Sciences Unit, Cambridge), exploited repetition priming (the effect that lexical decision Reaction Time [RT] is faster upon second presentation of a stimulus item) to examine segmental mismatches in lexical access. If minimally mismatching input activates the stored representation of a word, RT to a subsequent presentation of that word will be facilitated. In an experiment in English, listeners heard nonwords such as *cummel* which minimally mismatches the existing words *camel* and *cuddle* by a vowel and a consonant respectively, and performed lexical decisions upon visual strings presented immediately after the spoken nonword. No priming effects were found for visually presented words (e.g. *CAMEL*) preceded by minimally mismatching nonwords (e.g. *cummel*) versus by control nonwords. In another experiment, in Dutch, listeners performed a continuous lexical decision task on spoken words and nonwords. Target words were preceded by word or nonword primes mismatching on only a vowel, only a consonant, or many segments; for

example, *kaper* 'pirate' preceded by *koper* 'buyer', *kamer* 'room' or *gretig* 'greedy'; *lepel* 'spoon' preceded by *lopel*, *lemel*, *gukte*. The prime was separated from the target by 0, 1, 2 or 3 intervening items. This experiment produced no effects of whether primes were words versus nonwords, and no facilitation effects when any items intervened between prime and target. However, significant facilitation by both consonant- and vowel-mismatch primes occurred when primes preceded the targets immediately. Thus in priming tasks, real words can be activated by input mismatching on either a vowel or a consonant; the activation is short-lived, however, disappearing after even one intervening word. Moreover, it is specific to spoken word forms and cannot transfer to responses to visual input.

2.1.2 Activation of spuriously embedded words

Stretches of speech sometimes accidentally correspond to unintended words. For instance, *dental* occurs in *accidentally*, and *dismay* spans the boundary in *nobody's making*. McQueen, Cutler and Norris conducted a priming experiment investigating whether words accidentally embedded across word boundaries are themselves activated. Listeners heard two-word sequences, and performed a lexical decision task on a concurrently presented visual string. Some of the visual strings corresponded to embeddings in the two-word nonsense sequence, (e.g. *belang* 'interest', in *tube langzaam* 'tube slow'). Response times were unaffected by the presence of embedding (i.e. responses to BELANG were no faster after *tube langzaam* than after a control sequence). However, error rates significantly decreased in the presence of embedding (i.e. BELANG was less likely to be erroneously rejected after *tube langzaam* than after a control sequence), suggesting that there is some activation of spuriously embedded words which span word boundaries in continuous speech.

Analyses of the MARSEC corpus (the machine-readable version of the Spoken English corpus, see Annual Reports 1994, 1995, 1997) have shown that lexical embedding is very extensive, both within words, and between words in continuous speech. Baayen, McQueen and Cutler, together with Roach and Arnfield (both U. of Reading) are now exploiting the speech files of MARSEC (the original recordings of radio speech which form the basis of the corpus) to examine how similar, both acoustically and perceptually, embedded words are to non-embedded tokens of the same words. The corpus was searched for words spoken by the same speaker both as an embedding (such as *come* in *package company*) and as a non-

embedding (i.e. as the speaker intended, e.g. *come* in *perks can come expensive*). Acoustic analyses of these words showed that the embedded words were significantly shorter than non-embedded words (embedded-word duration was, on average, only 82% of non-embedded-word duration). Both types of words were presented to listeners in a simple identification test. The non-embedded words were identified significantly better than embedded words (56% versus 39% correct). These results suggest that although embedded words do differ from non-embedded words, they are still sometimes identifiable, and thus should often be activated during speech processing. Research using priming tasks, such as that reported above and that examining words within words (e.g. *bone* in *trombone*, see Annual Report 1997) suggests that embeddings are indeed activated, but that competition from stronger candidate words can quickly suppress that activation.

2.1.3 Phonological priming

Slowiacek (Bowdoin College, Maine, USA) and McQueen have continued to investigate phonological priming (see Annual Reports 1996, 1997). Facilitation (faster lexical decision times or faster repetition times) occurs when a target word is preceded by a prime word or nonword with which it rhymes (e.g. *bound-mound*) than when the prime is phonologically unrelated (*bolt-mound*). Inhibition (slower responses relative to an unrelated control) occurs when a target shares several initial sounds (*mount-mound*). New research in 1998 has again shown that phonological facilitation is very robust and that the presence of rhyming trials in an experiment can block any inhibition effects. These findings suggest that the facilitation is due to task-specific processes, rather than to automatic lexical access processes; the inhibition is due to lexical competition and the effects of competition can be hidden when rhyming trials induce the task-specific processes which produce the facilitation. In further experiments, it was shown that facilitation also occurs in a continuous lexical decision task, where responses are required on every trial (rather than only to the second member of every prime-target pair). There were strict limits on the facilitation however: as in the repetition priming experiment reported above (2.1.1), if even one intervening item occurred between prime and target (*bound-wasp-mound*), no facilitation was observed. These results are consistent with the idea that facilitation only arises when listeners detect the phonological congruency of a rhyming pair.

2.2 Segmentation of continuous speech

2.2.1 Transitional probability

Van der Lugt continued his work on the possible utility of transitional probabilities in the segmentation of speech. Weak effects in earlier word-spotting experiments (see Annual Report 1997) suggested that it is easier to detect a word in a nonsense context when it is followed by a very common Consonant-Vowel (CV) onset than when it is followed by a rare CV onset; no reliable effects were found, however, for words with preceding contexts. A new series of word-spotting experiments investigated the effects of transitional probabilities *within* the target words. The results suggest that listeners use these types of sequential probabilities to detect words embedded in longer sequences. The exploitation of sequential probabilities as a cue for segmentation, however, seems to be limited in two different ways. Firstly, probability information seems to be used more effectively when the phoneme sequence signals the likelihood of the onset of a new word than when it signals the offset of a word. Secondly, transitional probability has a stronger effect when the phoneme sequence is part of the word than when the sequence occurs in the surrounding context.

2.2.2 Morphology

As was argued in previous Annual Reports (1996, 1997), the Possible Word Constraint requires that the competition process parse speech such that no impossible words are left over. Thus, in languages like English and Dutch, single consonants fail the PWC because words in these languages have to contain at least a vowel. Some single consonants, however, are legal inflectional affixes in Dutch. Do these single consonant morphemes pass or fail the PWC? Mauth carried out a word-spotting experiment in which subjects had to spot monosyllabic Dutch nouns in three different nonword contexts. Words were embedded in *syllabic* contexts (e.g. *ham*, 'ham', in *hampijk*; *duim*, 'thumb', in *duimfoel*), *consonantal* contexts (*hamp*, *duimf*), or *morphological* contexts, using either the verbal inflection [t] or the plural marker [s] (*hamt*, *duims*).

The results confirmed other findings showing that Dutch listeners use the PWC in segmentation (1.4.2). Spotting words in *syllabic* contexts was significantly faster than in *consonantal* contexts. It was predicted that, if the PWC was a purely *phonological* mechanism, word-spotting should have been as hard in the *morphological* condition as in the *consonantal*

condition. If, however, inflectional affixes pass the PWC because they are meaningful units, it was predicted that word-spotting should have been as easy in the *morphological condition* as in the *syllabic condition*. Response times in the morphological context were faster than in the consonantal context but slower than in the syllabic context, and did not differ significantly from either.

2.3 Phonetic categorization

2.3.1 The time-course of lexical involvement

McQueen, Norris and Cutler examined how the influence of lexical knowledge on phonetic decisions changes over time. A [f]-[s] continuum in initial position in monosyllables was used to make word-nonword and nonword-word continua: *flauw* 'dull' - *slauw* and *flaap* - *slaap* 'sleep'. Syllable-final continua were made in the same way: *mat* 'silly' - *mas* and *jaf* - *jas* 'coat'. In a categorization experiment, there was a significant lexical effect for both initial and final fricatives: there were more [f] responses in the word-nonword continua than in the nonword-word continua. Lexical involvement was strongest in the listeners' fastest responses but disappeared in their slowest responses, both for the final fricatives (in line with previous findings) and the initial fricatives (contradicting earlier studies showing the strongest effects in the slowest responses). A second experiment tested whether listeners would still use lexical knowledge under severe time pressure. They were asked to respond before a tone, presented 500 msec after fricative offset. The results replicated the first experiment. Lexical knowledge appears to be used in phonemic decision-making only within a limited time frame. These findings will be used to define further the Merge model's account of perceptual decision-making.

2.3.2 Sentential context effects

In her final-year undergraduate project, Van Alphen (U. of Utrecht) looked at the categorization of a [t]-[d] continuum in the Dutch function words *re* 'to' and *de* 'the' embedded in different sentence contexts. In the first experiment, a de-biased sentence (*Ik probeer de/te schoenen* 'I try the/to shoes') was compared with a /e-biased sentence (*Ik probeer de/te schiefen*, 'I try the/to shoot') and an ambiguous sentence (*Ik probeer de/te schaatsen*, 'I try the/to skate(s)'). The proportion of [t] responses in the ambiguous sentence was greater than that in the de-biased sentence, but less than that in the re-biased sentence, and the difference between the

two biased sentences was significant. This effect was strongest in listeners' fastest responses. In a second experiment, the disambiguating context preceded rather than followed the to-be-categorized sounds; no strong bias effects were observed. In a final experiment, the disambiguating context again followed the *te-de* continuum, but appeared three syllables later than in the first experiment. A weak bias was found in the subjects' slowest responses. As with lexical involvement, the influence of sentential context on phonemic decision-making seems to have a narrow time-window. If the biasing information arrives either too early or too late, it appears not to influence categorization decisions.

2.3.3 Hierarchical processes

Phonetic decision-making is influenced not only by lexical and sentential contexts but also by phonetic context. Smits is examining processing dependencies in phoneme recognition, that is, how the categorization of a phoneme depends on the acoustical and phonological properties of surrounding phonemes. This research is aimed at developing a theory of phonetic categorization in which it is assumed (1) that phonetic categorization is fundamentally a multi-dimensional pattern recognition problem, and (2) that categorization is based on the statistical distribution of the acoustics of speech that listeners have previously categorized. A quantitative model of hierarchical categorization, HICAT, predicts for various levels of coarticulation what type of processing dependency is likely to be used by a pattern recognizer. It is assumed that the recognizer operates under time pressure; it therefore tries to minimize classification complexity while maximizing classification accuracy. For phonetic distinctions where coarticulation is not severe, the cue distributions allow listeners to use simple, independent categorization strategies while still performing close to optimally. Severe coarticulation, on the other hand, such as in assimilation processes, may necessitate a more complex strategy involving categorization dependencies which reflect dependencies in the cue distributions.

The theory was tested experimentally for the categorization of fricatives and vowels in fricative-vowel syllables with regressive rounding assimilation. Spectral locations of fricative and vowel resonances in the syllables [si, sy, Jijy] were measured, using a large set of naturally spoken tokens. Frequencies of fricative resonances were found to be highly dependent on the rounding of the following vowel. On the basis of this finding, it was predicted that listeners' fricative categorizations in these

syllables would be dependent on their vowel categorizations. Next, a categorization experiment was run using a synthetic two-dimensional fricative-vowel continuum. The HICAT model was fitted to the obtained categorization data to test whether listeners' categorization strategies had involved dependencies, and, if so, what the direction of the dependencies was. In agreement with the prediction based on the acoustical distributions, it was found that the listeners had used strategies in which the fricative categorization depended on the vowel categorization.

3 SIMPLE UTTERANCE GENERATION

Over the last decade, the long term Institute project on lexical access in speech production has provided a theory of generating single phonological words, a detailed computational model, WEAVER (developed by Roelofs), of most core components in the theory, and an extensive experimental data base in support of the theory. A comprehensive review of these results has been published (Levelt, Roelofs, & Meyer 1999 BBS) and we have applied the theory to a reanalysis of brain imaging studies of word production. Although there is still much to be further developed within this framework, it is by now sufficiently detailed to be applied with profit to the generation of longer utterances, where there is multiple lexical access.

Indeed, over recent years several studies carried out in the Institute and by colleagues elsewhere have addressed multiple lexical access in the generation of noun phrases and simple conjunctions. These studies have demonstrated a complex interplay of component processes. For instance, the units of conceptual and grammatical preparation in scene description depend on visual properties, such as object size. Meyer found that when two displayed objects of about the same size are described by a simple coordinate expression (such as *the dog and the baby*) both noun lemmas (i.e. their syntactic specification) are retrieved before utterance initiation, but not if the objects differ much in size. If the objects differ greatly in size, only the first lemma is retrieved before utterance onset. Work by Schriefers shows that encoding the (gender-marked) adjective in Dutch Determiner-Adjective-Noun phrases depends on accessing the noun lemma. These and other findings raise the more general issue of how the time course of multiple lexical access is organized in dependence on visual, attentional, grammatical and phonological factors. We have decided to systematically incorporate these issues into our project and

have correspondingly broadened the project's title to 'Simple Utterance Generation'. It will continue the study of single word generation, testing and extending the WEAVER model wherever possible. It will, furthermore, develop method and theory for studying multiple lexical access.

3.1 Generating single phonological words

3.1.1 Morphological encoding

The previous Annual Report mentioned experimental findings by Janssen showing that the generation of inflected forms (such as tensed verbs and plural nouns) involves the use of word-specific inflectional frames, with slots to be filled. For instance, a regular Dutch verb has an inflectional frame with one stem slot and two affix slots, one for tense and one for number. Dutch nouns have one affix slot, for number. Morphological encoding is facilitated when the inflectional frame is primed. The morphological encoding of a regular verb does not prime the morphological encoding of a noun because their inflectional frames differ. But, as Janssen showed in a series of new experiments in 1998, the morphological encoding of an irregular verb (which has a single, not a double affix slot) does facilitate the morphological encoding of a noun. Hence, it is not the word class that matters, but the surface composition of the frame in terms of stem and affix slots.

In further experiments, a similar question was posed for the second and third person singular -f suffix (as in *hij werkt*, 'he works'). According to the theory, the inflectional frame of regular verbs includes a slot reserved for this affix. However, for verbal stems that end in /t/, no -f suffix is heard or written (e.g. *hij zweet*, 'he sweats'). Janssen tested the hypothesis that these verbs do not undergo -t inflection and that their frames, therefore, lack the corresponding slot. The results of his implicit priming experiments support this conclusion.

3.1.2 Incremental phonological encoding and suprasegmentals

A core feature of phonological encoding in the theory is that a morpheme's spelled-out phonological segments are successively chunked to create phonological syllables. Linguists and psycholinguists have proposed representing segmental length independently of segmental content in terms of the number of positions on a CV, X-slot, or moraic tier. Short segments are associated to one position and long segments to two positions. In contrast, Roelofs' WEAVER model does not represent X-slots

or moras as part of a word's metrical structure and treats long and short vowels as different segments. Within WEAVER, length can either be represented as a feature of a segment (and hence short and long segments are *different* segments) or, alternatively, as a repetition of the *same* segment. Roelofs and Meyer carried out two implicit priming experiments to decide how phonological length is represented. On each experimental trial, participants produced one word from a small set in response to a prompt. In the heterogeneous condition, the responses were unrelated in phonological form. In the two homogeneous conditions, the words shared onset and nucleus segments. In one homogeneous condition (the constant condition), the nucleus was either long in all responses (as in *maat, maan, maag, maand*) or it was short in all responses. In the other homogeneous condition (the variable condition), vowel length varied across response words within a set (as in *malt, maan, map, markf*). Sharing the onset and nucleus yielded facilitation. This facilitatory effect was larger in the constant than in the variable condition. In earlier research, Roelofs and Meyer (1998) had shown that variability or constancy of the CV or X-tier per se did not affect the strength of the facilitator effect obtained in implicit priming experiments. Therefore, the present findings suggest that short and long segments are represented in memory as different segments, thereby supporting WEAVER.

3.1.3 Generating syllables

Schiller extended his work on the role of the syllable during phonological encoding in speech production (see 1997 Annual Report). In 1998, Schiller showed that in Dutch syllables cannot be primed. In five masked priming experiments, he found significant effects of segmental overlap — the longer the primes, the stronger the priming effects — but no sign of a syllable priming effect. For example, *de####* primed the production of *de.ler* 'divisor' just as well as *delta* 'delta' although these words differ in the structure of their first syllable (CV versus CVC). Furthermore, *de###* yielded more priming than *de####* for both CV and CVC targets. These results are compatible with the WEAVER model. Segments are marked for their serial position within a morpheme but not for their position within a syllable. Only later in the process of phonological encoding are segments specified for their syllabic position. It is worth reporting here that after moving to Harvard's Cognitive Neuropsychology Laboratory this year, Schiller extended his findings to English. In one picture naming and three

word naming experiments he obtained similar results for English, contrary to what has been claimed in the literature.

3.2 Borderline cases of single versus multiple word access

3.2.1 When prime words become targets

In the classic picture-word interference studies, on which much of the WEAVER modeling is based, the picture name is the target and the printed or spoken distracter word is the prime. The subject is instructed to ignore the prime. In this paradigm, one usually obtains facilitation from phonologically related primes (relative to unrelated ones) and inhibition from semantically related primes. But what if the prime word is not ignored? This is the case, for instance, when the subject is instructed to name the distracter instead of the picture or in a multiple access task where the subject names the target first and then the distracter. Wissink carried out experiments in which participants heard words and simultaneously saw pictures of objects. The object name and the auditory word were either semantically or phonologically related or unrelated. Across experiments, the participants' task varied: They either named the object in the picture (saying, for instance, *de hond*, 'the dog'), repeated the word they heard, adding the determiner (*de koe*, 'the cow'), or produced a noun phrase conjunction including the auditory word and the object name in either order (*de hond en de koe* or *de koe en de hond*). When the participants named the target pictures, there was semantic interference (i.e. a longer mean naming latency in the semantically related than in the unrelated condition). By contrast, when the participants reproduced the auditory distracter words with their determiners, there was semantic facilitation. Finally, when the object and the auditory word were both named (in either order), there was no difference between the semantic and the unrelated condition. This is exactly the pattern predicted by WEAVER. According to the model, the lemmas of the auditory word and the picture name activate each other in the related condition, with the lemma of the auditory word benefiting more from this activation than the object name's lemma. This yields facilitation in word naming, inhibition in object naming, and a cancellation of effects when both word and object are named.

In the phonological condition there was, as expected, facilitation (relative to the unrelated condition) when the picture was named and inhibition when the auditory word was reproduced. This latter result is particularly

interesting. Apparently, the phonetic form of the picture name becomes available and interferes with the reproduction of the words, even though in the entire experiment the speakers never overtly name the pictures. Sleiderink obtained a similar result. On each trial of her experiment, speakers named a picture which was replaced by a new, masking picture to which the speakers did not overtly react. The replacement of the picture took place after 350 msec, which is about 150 to 200 msec before speech onset. The target pictures were named more rapidly when the masking picture was phonologically related than when it was unrelated to the named picture. This demonstrates that the names of the masking pictures, which were not to be named, were nevertheless retrieved.

3.2.2 Producing number names

Number names occupy a curious position in between single and multiple word access. There is evidence from resyllabification that multiple-digit names are produced as single phonological words. For instance, the number 108 can be pronounced in Dutch as *hon-der-tacht*, with resyllabification of the last consonant of *honderd* into the initial position of the word *acht*. Still, number names show a degree of generativity that surpasses normal Dutch morphology. It is standard practice in linguistics to talk about the syntax of number names, i.e. to consider them phrases. They are also exceptional in that in spite of their productivity, they behave like fixed expressions. Among many idiomatic features is their deviant pluralization. In Dutch, they have very limited pluralization as noun phrase quantifier, but they pluralize freely in other contexts. In addition, pluralization is phonologically archaic. Levelt wrote a simple grammar for Dutch number names as a basis for a production system which maps multiple-digit numbers onto number names. The production theory was tested and partially confirmed in an experiment in which subjects named one- to three-digit numbers. Results showed that the latency of accessing decade and unit number morphemes increases sharply with quantity, which is in turn related to digit frequency.

3.3 Generating multiple word phrases and sentences

3.3.1 Tracking eye movements in scene descriptions

As reported in the 1997 Annual Report, we developed a new experimental paradigm to tap the speaker's allocation of attention during the production of simple utterances. This paradigm involves monitoring the speaker's eye movements. We exploit the fact that a person's attention is usually

directed at the fixated object and that a shift of gaze is mandatorily preceded by a shift of attention. Hence, we can use eye tracking to determine when and for how long different parts of a picture are attended to. Meyer, assisted by Van Elswijk and Hermens (both U. of Nijmegen), spent much effort in 1998 on the improvement of the facilities for setting up eye movement experiments and analyzing the data.

Meyer, Sleiderink, and Levelt (1998) in addition to Van der Meulen carried out a set of eye tracking experiments in which participants named object pairs or sets of four or five objects. These studies showed that speakers fixated upon each of the objects in the order of mention on more than 80% of the trials. Similarly, a study by Meyer and Rijpma (U. of Groningen) showed that when speakers describe simple pictures of actions (saying, for instance, *the boy is feeding the dog*), they first search for the agent and fixate upon it for about 400 msec and then turn to the patient or recipient. Thus, speakers successively fixate upon and attend to each part of a picture to be described.

How long do speakers attend to an object? The visual-conceptual processes of picture identification demand attention, but lexical access is often assumed to be a fairly automatic process. Hence, one may predict that speakers shift gaze and attention from one object to the next as soon as each object has been identified. This is, however, not what was found. In the experiments using object pairs, the viewing time for an object depended, among other things, on the time required for lexical access to the phonological form of the object name. This was evidenced by phonological priming and name frequency effects on the viewing times.

In a new series of experiments, Meyer presented speakers with pictures of small and large colored objects. The speakers either named only the objects (*the ball*) or also their color and size (*the small green ball*). The mean viewing time for the objects depended, as in the earlier experiments, on the frequency of their names. In addition, the mean viewing time and the coordination of the eye movements with the speech output varied greatly across utterance types. When speakers produced just a noun, the shift of gaze from the first to the second object occurred about 400 msec after picture onset and about 200 msec before speech onset. When the speakers included the adjectives in the first noun phrase, the shift of gaze occurred about 300 msec *after* speech onset, about 1100 msec after picture onset. Analyses of the speakers' speech showed that in both cases, the shift of gaze occurred about 250 msec before the onset of the

head noun (*ball*). This finding, and the effect of the noun's frequency on the viewing time, show that speakers fixated upon the object until the phonological representation of the entire utterance referring to it had been created. This is an unexpected and interesting conclusion, given that many current models of language production stress that lexical access is an automatic process and that speakers can carry out several planning processes in parallel.

Although the objects of a display were fixated upon and attended to in sequence, objects were already processed to some extent while they were still in the visual periphery. This is evidenced, for instance, by Sleiderink's finding that an object to be named was viewed for a shorter period and named faster when the next object to be named, appearing to its right, was rotated by 120 degrees, compared to when it was upright. One account of this finding is that the rotated object was more difficult to recognize and that therefore the corresponding conceptual and linguistic units interfered less with those of the target than the units of an upright object.

If it is generally true that the viewing time for an object is determined by the time necessary for object recognition and for the linguistic processing of the corresponding utterance, viewing times should be very short when speakers use very simple expressions, like pronouns. Van der Meulen tested this prediction by comparing how speakers coordinated eye movements and speech output when they produced noun phrases and pronouns. In the first experiment, speakers were instructed to refer to objects (already seen on the preceding trial) either by a full noun phrase or by a pronoun (*the ball/it is now next to the table*). As expected, speakers almost always fixated upon the target objects when they were seen for the first time. When they reappeared on the next trial, they were still fixated upon in about 80% of the trials, more often when noun phrases than when pronouns were used. Most importantly, the mean viewing time for the objects was longer in the noun than in the pronoun condition.

In the second and third experiments, speakers described action scenes in response to questions (e.g. *What is happening?* or *What is the man doing?*). They were free to choose nouns or pronouns to refer to the agents (as in *The man/He is throwing the ball.*); all participants chose pronouns on some trials and nouns on others. In one experiment, there were only two nouns (e.g. *me man and the woman*) and two pronouns (*he and she*) to choose from. The eye movement results corroborate those of

the first experiment. The inspection rate for the agent was lower and the mean viewing time shorter when the speakers chose pronouns than when they chose nouns. There are, of course, many reasons why the planning of pronouns could be easier than that of the nouns and further research must determine which of them were responsible for the differences in viewing times. The important point to note now is that when speakers chose a simpler or a more complex utterance to refer to an object, the viewing times changed accordingly. This supports the earlier conclusion that the viewing time for an object is directly related to the time required for the conceptual and linguistic processing of the object and its name. This implies that the speaker's attention only shifts to the next object when all of these processes have been completed.

3.3.2 Subject-verb agreement

Meyer, Fransen, Schriefers (U. of Nijmegen), and Bock (U. of Illinois) studied the generation of Dutch subject-verb number agreement using a sentence completion task. On each trial, speakers heard the beginning of a sentence (a so-called preamble), repeated it, and then completed it to form a full sentence. The preambles of the critical items consisted of a singular subject noun followed by a prepositional phrase including an interloper which could be a singular count noun (as in *the bowl with the apple*), a plural count noun (*the bowl with the apples*), or a collective (*the bowl with the fruit*). As expected, speakers occasionally committed agreement errors (saying, for instance, *the bowl with the apples are red*), but only in the plural condition. The collectives were treated like ordinary singular nouns, even though conceptually they refer to groups of items. This was true when students and when older adults were tested; when they only heard the preambles and when, in addition, they saw accompanying pictures illustrating the scenes. Thus, contrary to the evidence by other researchers, these results strongly suggest that in computing subject-verb agreement, Dutch speakers consider primarily grammatical information; conceptual influences are weak at best.

4 NEUROCOGNITION OF LANGUAGE PROCESSING

On January 1, 1998, the five year follow-up grant from NWO to the Neurocognition project began. The end of the former NWO-grant and the start of the new grant meant that not all contracts of project staff could be extended. Some new appointments were made, however, and an additional grant application was submitted to continue an important part of the neurocognition research that could not be supported by the NWO-grant. A grant from the German Science Society (DFG), submitted by Zwitserlood (U. of Münster) and Hagoort on behalf of Van Berkum was awarded. This allows Van Berkum to carry on with ERP research on discourse processes for two more years.

4.1 The neural architecture of language processing

4.1.1 The neural architecture of syntactic production

Indefrey, C. Brown, Hagoort, and F. Hellwig, in collaboration with Herzog (Institut für Medizin, Forschungsanlage Jülich), and Seitz (Heinrich-Heine-U., Düsseldorf) completed a PET experiment on syntactic production. For this experiment, an experimental paradigm was developed for the controlled **elicitation** of naturally produced responses with different degrees of syntactic encoding ('restrictive scene description'). Subjects described animated visual scenes (see Figure 1) involving a fixed set of three geometrical objects of different grammatical gender in German, three colors, and two actions ('go next to', 'push away'). The actions were performed by one or two agents. Beginning with the agent(s), all action participants had to be named in all conditions, along with their respective colors and the action, ensuring constant conceptual processing. Subjects

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were instructed to describe the scenes either in a full sentence (S), with a sequence of noun phrases (NP), or with a sequence of single words (W). Here is an example of the perceptual scene and the three syntactic encoding conditions:

Perceptual Scene:

Red square pushes blue ellipse away.

Syntactic encoding conditions:

(S): *Das rote Viereck stößt die blaue Ellipse weg.*

The red square pushes the blue ellipse away'.

(NP): *rotes Viereck, blaue Ellipse, wegstoßen*

'red square, blue ellipse, to push away'

(W): *Viereck rot, Ellipse blau, wegstoßen*

'square red, ellipse blue, to push away'

The productions of the subjects in the three conditions did not differ in onset or duration of verbal responses. Analysis of the regional cerebral blood flow (rCBF) data yielded, for the maximal contrast (S-W), the left frontal operculum as the only area with a highly significant ($p < .02$ corrected, $p < .000$ uncorrected) rCBF increase (see Figure 2). At a more liberal statistical threshold ($p < .01$ uncorrected), this area was also found to be activated in the S-NP comparison. A conjunction analysis, testing for common activations across contrasts, showed that not only the contrasts S-W and S-NP, but also S-W and NP-W, shared the activation of the left frontal operculum ($p < .001$, uncorrected). The signal intensity of the maximally activated voxel showed a graded response with the lowest value for W, intermediate value for NP, and highest value for S. These findings point to a role for the left frontal operculum in syntactic encoding. The obtained response pattern suggests that this area is not only sensitive to syntactic encoding at the sentence level but also at the noun-phrase level.

4.1.2 The neural correlates of word production

Indefrey and Levelt analyzed the data of 58 language production brain imaging experiments which used different experimental tasks and imaging techniques. The locations of the reported activations were recoded in an anatomical reference system of 104 regions covering the whole brain. Due to the heterogeneity of the imaging techniques in the different studies not

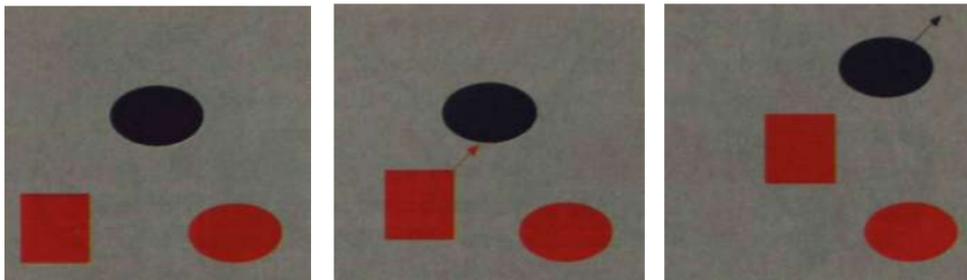


Figure 1. Stimulus example of syntactic production experiment.

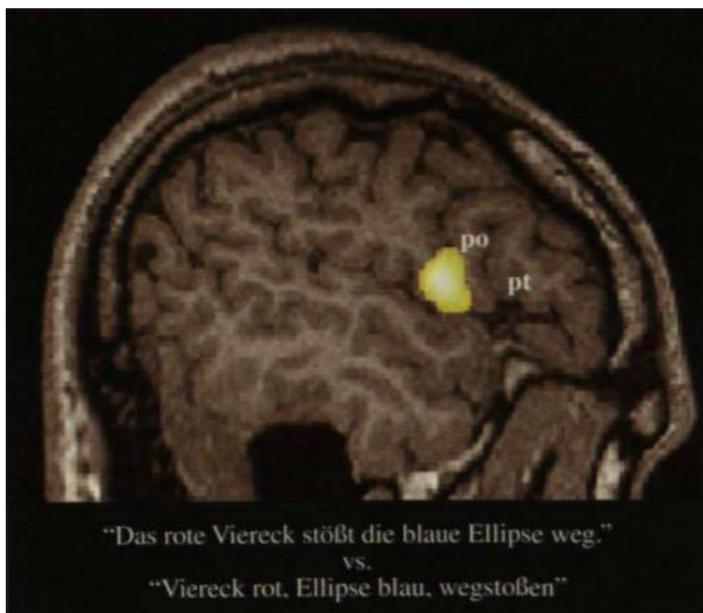
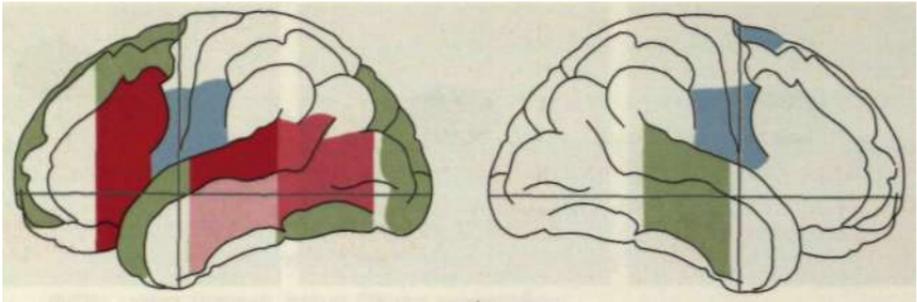


Figure 2. Cortical activation of 'sentence' relative to 'single words' responses. Significantly activated voxels ($p < .02$ corr., .000 uncorrected) are projected onto anatomical MR section of one typical subject. The centre of the activation area is located in the left frontal operculum, caudally adjacent to Broca's area. (pt=pars triangularis, po=pars opercularis of inferior frontal gyrus)



- task specific
- specific for overt responses
- common to picture naming and word generation
- common to picture naming, word generation, and word reading
- common to picture naming, word generation, word reading, and pseudoword reading

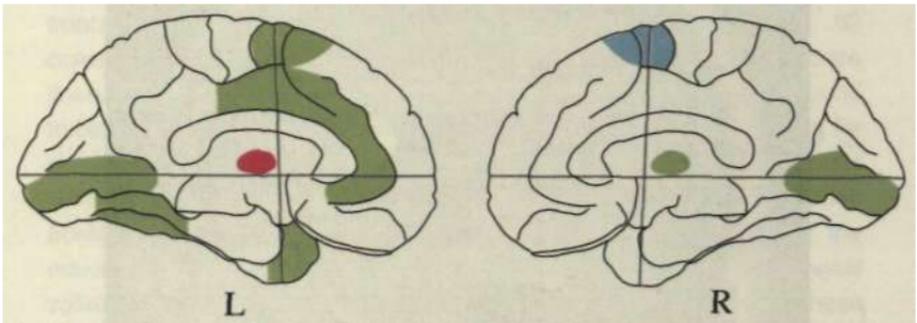


Figure 3. Pattern of brain activations for different word production tasks across 58 experiments reviewed in Indefrey and Levelt (in press). Green areas were reported for picture naming but not for word generation or vice versa. They are not related to the core process of word production as such but rather reflect task-specific lead-in processes. Reports on activations of blue areas depended on whether word production was silent or aloud. These areas are related to phonetic encoding and/or articulation. All pink and red areas were reported for picture naming as well as word tasks. They reflect the core process of word production up to and including phonological encoding. The dark pink region (Wernicke's area) seems to be related to the retrieval of the lexical word form, whereas the red areas, which were reported for all tasks including pseudoword reading, seem to be related to post-lexical phonological encoding.

all cortical areas were measured equally frequently. Therefore, a probability threshold criterion was applied to the number of experiments which had to agree in their reports on a certain brain area.

The analysis was guided by theoretically motivated assumptions about the processing components of word production that are tapped by different experimental tasks, such as picture naming, word generation, reading of words, and pseudowords. It was postulated that brain areas subserving certain processing components must be found for all tasks sharing these components. Conversely, brain areas that were not found for all tasks with a common processing component were assumed not to be related to this processing component but to reflect task-specific processes.

The meta-analysis revealed a left-lateralized network for the core process of word production up to and including phonological encoding. It consists of the posterior inferior frontal gyrus (Broca's area), the mid superior and middle temporal gyri, the posterior superior and middle temporal gyri (Wernicke's area), and the left thalamus. By taking into account tasks that enter the word production process at later stages, it was further possible to identify the processing components which the regions within this network are specifically sensitive to (see Figure 3).

4.1.3 The localization of functional brain activation data

Functional imaging data are usually reported in terms of 'Brodmann areas', as convenient 'subdivisions' of the cortical lobes. Strictly speaking, this is incorrect, since Brodmann areas are cyto-architecturally defined and no such information is available for experimental subjects. Based on cyto- and receptor-architectonic analyses of Broca's area, Amunts (C. and O. Vogt Institute for Brain Research, Düsseldorf) has obtained cortical maps coding the probability that cortical locations belong to Brodmann areas 44 or 45. Indefrey, in collaboration with Amunts, is currently developing a procedure to map functional brain activation data obtained with the SPM statistical program package onto these brain maps. This mapping will enable much more precise answers about where language-related cortical activations are located with respect to Broca's area.

4.2 Syntactic and semantic integration processes during comprehension

4.2.1 ERP studies on sentence processing in discourse

Van Berkum, continuing his ERP research in collaboration with C. Brown and Hagoort, obtained new evidence about the use of grammatical gender in syntactic parsing, on anaphoric processing in spoken discourse, and on the effects of discourse-semantic anomalies in connected speech (the latter two in collaboration with the Phonological Structure in Comprehension project).

4.2.1.1 When does gender constrain parsing?

In some theories of parsing, grammatical gender is assumed to immediately and categorically block gender-incongruent phrase structure alternatives from being pursued. In other theories, the parser initially ignores grammatical gender altogether. Our recent ERP findings suggest an intermediate position. The evidence comes from the way discourse context and grammatical gender interact in controlling how the parser temporarily resolves a local syntactic ambiguity. Earlier research (see Annual Report 1997) with sentences like *David vertelde het meisje dat...*, 'David told the_{neU} girl_{neU} that' showed that discourse context can very rapidly affect the analysis of *dat*: with two referents in context, the parser is more inclined to focus on a relative-pronoun analysis (...*het meisje dat had gebeld...*, The girl that had been on the phone'), whereas with just one available referent, it is more inclined to focus on a complementizer analysis (...*dat er v/s/fe kwam ...* that there would be some visitors'). For the current issue the neuter-gender NP was replaced by one of common gender (e.g. *David vertelde de vrouw dat.* 'David told the[«]™ woman[™] that'...). Because common-gender nouns require the relative pronoun *die*, this formally ruled out the relative-pronoun reading of *dat*. Native speaker intuitions suggested, however, that with two referents in context, '...de vrouw dat...' feels like a gender violation. This led to the speculation that *dat* was momentarily taken as a relative pronoun in spite of its incorrect gender, and that it was immediately ruled out thereafter.

This was pursued experimentally by presenting common-gender sentences in 1- and 2-referent discourse contexts. If gender-incongruent analyses are not immediately blocked from consideration, a 2-referent context should at least momentarily lure the parser into pursuing the relative-pronoun analysis of *dat*. Furthermore, if the resulting gender

incongruency is used to dispose of such an analysis immediately thereafter, the parser should, in this context, be led into a garden-path at the same word. Because syntactic garden-paths reliably elicit a P600/SPS in ERPs, this account therefore predicted a P600/SPS effect at *dat* in a 2-referent context. The prediction was unequivocally confirmed. The results show that, although gender is processed rapidly enough to have the parser dispose of an ill-formed analysis within some 500 msec, it does not categorically prevent the system from at least momentarily pursuing an analysis that is strongly supported by the discourse.

4.2.1.2 Anaphoric processing in spoken discourse

An earlier study (see Annual Report 1997) had shown that when people read a singular definite NP like *het meisje* 'the girl' in context, they immediately look for a suitable referent in the earlier discourse and detect referential ambiguity within a mere 250-300 msec after the onset of the written head noun. To examine whether this finding would generalize to the processing of natural connected speech, Van Berkum, C. Brown, and Hagoort conducted a replication study with spoken materials. The preliminary results suggest that, just like its written counterpart, a referentially ambiguous spoken noun elicits a negative shift in ERPs at about 250-300 msec after its onset, which again indicates that referents are looked up in the discourse model within this very short time.

4.2.1.3 Discourse-level semantic integration in connected speech

Earlier work (see Annual Report 1997) revealed that if a locally coherent written word does not fit the semantics of the global discourse, the processing consequences show up in ERPs at about 200-250 msec after onset of this word (N400 effect). The preliminary results of a replication study now reveal that, in natural connected speech, such processing consequences show up even earlier, at about 100-150 msec after onset of the spoken anomalous word. This suggests that listeners relate an incoming spoken word to the semantic representation of the wider discourse far more rapidly than recent research on memory retrieval during language comprehension would lead one to expect.

4.2.2 The Syntactic Anterior Negativity (SAN)

A follow-up study on ERP effects of word-category violations (see Annual Report 1997) was performed by Hagoort, C. Brown, and Kooijman in order to further investigate the nature and the antecedent conditions of anterior negative shifts that might be related to syntactic processing. In the earlier

experiment, next to syntactically correct sentences, subjects were presented with sentences containing a word-category violation in the noun position of a noun phrase (e.g. *De anonieme ademen geeft een bijzonder licht*, 'The anonymous [to breath] gives a special light'). However, if the preceding adjective (i.e. *anonieme*) is interpreted as a noun, which in combination with an article is formally often possible in Dutch, one could argue that this could also be a morphosyntactic violation with the wrong number inflection (i.e. *ademen* instead of *ademf*). It was therefore decided to repeat the experiment with a more clear-cut case of word-category violations.

Subjects were presented with sentences that were semantically partly anomalous, with, in one version, a clear word category violation and, in the other condition, no syntactic violation. Here is an example of the materials:

(a) *De houthakker ontweek de ijdele schroef <Noun> op dinsdag.*

'The lumberjack dodged the vain propellor <Noun> on Tuesday'.

(b) *De houthakker ontweek de ijdele schroeft <Verb> op dinsdag.*

'The lumberjack dodged the vain propelled <Verb> on Tuesday'.

In both versions, the Critical Word (underlined) is: (1) in the same position, (2) closely matched in its semantic content, and (3) with zero cloze probability with respect to the preceding context.

ERPs to the word-category violation showed two effects. In the early window (300-500 msec), an anterior negativity was present (see Figure 4). Friederici has earlier reported a syntax-related anterior negativity, which she called LAN (Left Anterior Negativity). Our work has suggested that this is more bilateral than she supposed. This frontal negativity has a different distribution than the N400. Since it seems to be elicited by a syntactic violation, we prefer to refer to this effect as the Syntactic Anterior Negativity (SAN). Next to the SAN, the word category violation elicited a posterior P600/SPS effect. A precise functional characterization of the SAN within a model of sentence comprehension awaits further research.

4.2.3 Parsing preferred structures

Arguments in favor of constraint-based models of parsing and against depth-first models of syntactic processing have been largely based upon empirical tests of the influence of non-syntactic constraints on the comprehension of the structurally disfavored syntactic analysis. However, as has been argued by Frazier, constraint-based models

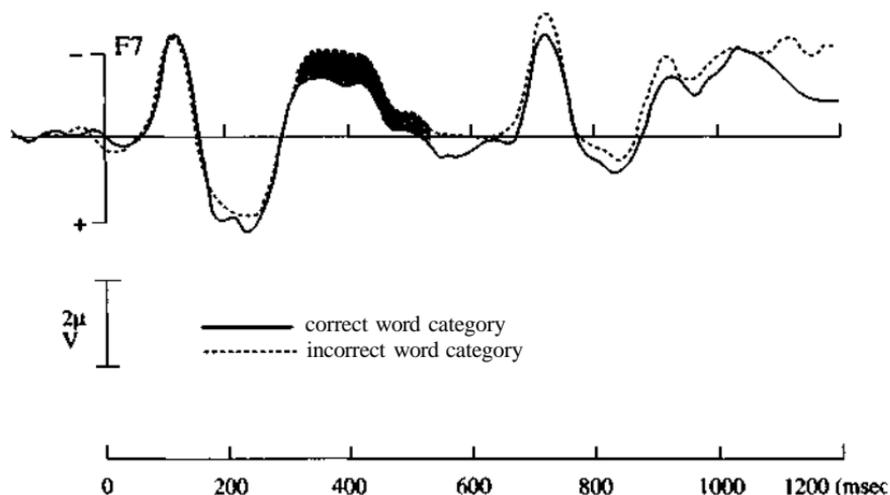


Figure 4. The Syntactic Anterior Negativity elicited by word-category violations. The figure shows the SAN for the left frontal electrode site F7. The effect is equally distributed over the anterior left and-right hemispheres. The onset of the word category violation is at zero milliseconds. The onset of the next word is at 600 milliseconds. Negativity is plotted upwards.

and depth-first models make the strongest diverging predictions about the role of non-syntactic constraints on the processing of the structurally preferred analysis. For depth-first models, the semantic plausibility of the structurally disfavored analysis should not influence the processing of preferred structures, whereas in constraint-based models it should.

The processing of the preferred analysis was the testing ground in an ERP experiment of Hagoort, C. Brown, and Kooijman in which the contextual support for the syntactically preferred analysis was manipulated. Syntactically ambiguous sentences which were disambiguated towards the preferred NP-conjunction analysis (e.g. *Een matroos zag de schipper en de kok vanaf <point of disambiguation> het dek*. 'A sailor saw the skipper and the cook from the deck') were preceded by three different types of context sentences (in three versions of the experiment):

Neutral context:

Er waren eens een schipper en een kok.

'Once upon a time there was a skipper and a cook'.

Contextual support for the preferred NP-conjunction:

De schipper en de kok voeren samen op zee.

The skipper and the cook were both at sea'.

Contextual support for the dispreferred S-conjunction:

De schipper zat op zee en de kok werkte aan wal.

The skipper was at sea and the cook worked on land'.

The nature of the contextual bias for the constructed materials was substantiated in a pretest. The ERP results showed the following pattern: The neutral context resulted in a P600/SPS to the disambiguating word relative to the same sentence preceded by a context that supported the preferred NP-conjunction analysis. In addition, the comparison of the two biasing contexts showed a P600/SPS in the context biasing towards the dispreferred S-conjunction. This P600/SPS manifested itself already at the second noun of the conjunction.

These results lead to the following conclusions:

- 1) Differences in the contextual support for the structurally favored NP-conjunction analysis have consequences for processing sentences disambiguated to this preferred reading. These processing differences showed up in the amplitude of the syntax-related P600/SPS.

- 2) A contextual bias against the structurally preferred analysis resulted in processing costs preceding the actual point of disambiguation, presumably due to the interplay between a default preference and a contextually induced support for the non-preferred analysis.
- 3) These results support a model with a separate level of syntactic processing (hence P600/SPS), but not with a model that posits an initial phase of syntactic autonomy in resolving structural indeterminacy.

4.3 ERP studies on language disorders

During 1998, Wassenaar completed the ERP data acquisition and analysis of an experiment on on-line syntactic processing in Broca's aphasics with agrammatic comprehension. An earlier experiment (see Annual Report 1996) showed that, when listening to sentences with grammatical violations, Broca's aphasics with severe agrammatic comprehension did not show a syntax-related ERP effect, unlike normal elderly control subjects and Broca's aphasics with mild agrammatic comprehension. Instead, the agrammatic aphasics showed a meaning-related ERP effect, reflecting their attempts to achieve understanding by the use of semantic constraints.

In a follow-up study, Wassenaar, C. Brown, and Hagoort tried to replicate these findings by presenting subjects with spoken sentences containing word-order violations. These syntactic violations were embedded in normal and so-called syntactic prose sentences (syntactic prose refers to sentences that are semantically uninterpretable, but are in accordance with the syntactic constraints of the language). This syntactic prose manipulation was used to test whether a possible emerging N400 effect would disappear in the syntactic prose condition, since a semantic compensatory strategy can not work for semantically incoherent sentences. In addition, sentences with subcategorization violations (e.g. violations of the constraint that obligatory intransitive verbs cannot take a noun as direct object) were also presented, both in a normal and in a syntactic prose version. In conjunction with the ERP experiment, agrammatic comprehension of the Broca's aphasics was assessed by a sentence-picture matching test for syntactic sentence comprehension. As a function of increasing syntactic complexity, the Broca's aphasics showed a significant decrease in comprehension.

The data of 13 age-matched control subjects, 10 Broca's aphasics, and 8 patients with a right hemisphere lesion have been analyzed. The data of the age-matched control subjects showed P600/SPS effects for the word-order violations both in the normal and in the syntactic prose condition, but the size of the effect was reduced in the syntactic prose condition. In the normal prose condition, this P600/SPS effect was preceded by a Syntactic Anterior Negativity (SAN), which was absent in the syntactic prose condition. For the subcategorization violations, significant P600/SPS effects were only found in the normal prose condition.

The Broca's aphasics also showed a frontally distributed negative effect for the word-order violations in the normal prose condition. Unlike the age-matched control subjects, this negative effect was not followed by a P600/SPS effect. Interestingly enough, a P600/SPS effect was found for the word-order violations in the syntactic prose condition. The presence of this effect in syntactic prose indicates that not all knowledge about syntactic constraints is lost in these patients. The reduced amplitude of the effect in the Broca's aphasics in the syntactic prose version relative to the age-matched controls indicates that their on-line sensitivity to structural information is weakened. It seems that a P600/SPS effect is absent when sentences offer the possibility of using a more semantically driven interpretation strategy, as is the case in the normal prose condition. For the subcategorization violations, no effects were observed for the Broca's aphasics, either in the normal or in the syntactic prose condition.

5 COMMUNICATION UNDER IMPAIRMENT

This project was instituted towards the end of 1996 and was intended to run for a two year trial period. Although the project has been very fruitful and productive, the two responsible staff members, Heeschen and Wilkins, have decided to discontinue it, and so this will be the final report for Communication Under Impairment. Although the project will dissolve, a number of the subprojects that have been pursued under this rubric will be continued within other larger project groups (such as Gesture and Argument Structure).

As noted in the 1997 Annual Report, the research in this project focuses on the interaction of a communicatively-impaired person with a non-inflicted interlocutor and is sensitive to the total communicative resources that patients and interlocutors draw on in discourse production. Thus, it is not only concerned with linguistic production, but also gesture, gaze, strategic use of silence, use of pointing boards, etc. A central area for investigation concerns the nature of adaptation to 'malfunction' in naturalistic discourse.

5.1 Structural properties of adaptations

5.1.1 Quantitative studies on the use of elliptic constructions (contextual ellipsis)

Heeschen's investigations of the structure of elliptic constructions used by aphasic patients were based on speech obtained in an interview-like situation which aimed at maximizing the turns of patients and non-inflicted control subjects. The basic results can be summarized as follows (the following percentages cover all classifiable elliptic constructions):

- (i) There is a massive preference for elliptic constructions without a subject-NP (83%); and
- (ii) The two most frequently used constructions were mere NPs (41%) and non-finite verbs (22%).

On average, 6-8% of all utterances from healthy German speaking subjects are elliptic. The speech of agrammatic aphasics contained a higher percentage of ellipses (ranging from normal up to 85%), but the distribution of types of elliptic construction was like that of normals. There were, however, three aspects with respect to which the agrammatics differed drastically from normals:

- a) While determiners for NPs were almost never omitted by normals, agrammatics omitted them in more than 50% of the NPs occurring in elliptic constructions;
- b) The ellipses of agrammatics contain substantially less elaborations (by means of adjectives, adverbials, arguments of a verb) than those of normals (*on average*, an ellipsis of a normal subject had 4 - 5 elaborating words, that of an agrammatic hardly more than 1); and
- c) The telegraphic utterances of agrammatics were frequently not only subsentential, but also incomplete with respect to their status as turn constructional units (see Annual Report 1997).

These investigations were extended to speech obtained in more naturalistic situations: peer-to-peer dyadic ordinary conversations. In normals, the results did not differ from those for speech in an interview. However, the agrammatics show a peculiarity: high frequency use of mere NPs is not as conspicuous; constructions with a non-finite verb (with or without subjects) occurs almost as often as NPs (33% NPs, 31% non-finite verbs). A closer inspection of delineable episodes in these peer-to-peer interactions revealed that this flatter profile of the frequency distributions is due to the fact that patients have certain preferences for special constructions over the span of a given episode (for example, one patient in one episode used non-finite verbs with a subject NP excessively - up to 45%; in another episode with the same co-conversant this constructional type made up only 4% of all elliptical constructions). These local imbalances suggest the need for closer qualitative investigation of the interactions.

5.1.2 Is there a common denominator explaining subject omission and determiner-omission in elliptic constructions?

As mentioned in the previous subsection, agrammatics (but not other types of aphasias and normals) show a strong tendency to omit the articles and other specifiers of the Determiner Phrase (DP) in non-finite constructions. Heeschen hypothesized that there would be a connection between the omission of grammatical subjects and of DP-specifiers, since a subject is the specifier of the INFL-phrase just as a determiner is a specifier of the Determiner Phrase. The results of a previous experiment were inspected from an elaborated theoretical-linguistic perspective. This was done together with Haverkort (Groningen U. and Boston U.). German patients were prompted into the naming of an object together with its possessor. German allows a variety of options for the expression of this relationship - in some of them the possessor is in specifier position, in others it is not. If both grammatical subjects and DP-determiners are omitted for the same reason (i.e. occupying the specifier position of a phrase), then one would expect a trend in agrammatics to more often use non-specifier positions for the possessor than specifier positions as compared to other types of aphasia and/or to normals. Actually, on average, agrammatics use the specifier constructions only 38% of the time, while in Wernicke's aphasias as well as in normals it is 59%. However, this difference is far from being significant. Some agrammatics show a strong preference for non-specifier constructions, but others have an equally strong tendency for specifier constructions. Thus, the hypothesis of a common denominator explaining subject omissions and DET-omissions is not confirmed.

5.2 The deployment of adaptive strategies in 'talk-in-interaction'

5.2.1 Conversation analytic investigations of ordinary conversations between agrammatics and familiar healthy peers

The investigations discussed in this subsection were carried out together with Schegloff (UCLA), and they are direct continuations of previous conversation analytic work on the same materials. The research question concerned the function of agrammatic telegraphic-elliptical speech in talk-in-interaction. On the basis of one patient, we conjectured that 'telegraphese' is deployed to prompt the healthy co-participant into speaking 'on the patient's behalf. One of the pieces of evidence which

supports this conjecture is the fact that in 'telegraphese' the patient did not show the preference for self-repair within same turn, which was the preferred repair strategy in the episodes without telegraphic utterances. Instead, after formulation troubles, the patient established herself as a recipient thus indicating that she would prefer an other-repair. This and similar observations could be made in two further patients. However, the deployment of 'telegraphese' as an 'invitation' for the other co-participant to co-construct appears to be dependent on the concrete interactional practices of the co-participant in a given episode. This observation might partially explain the previously mentioned fact that, in conversations, there is a strong variation across episodes within an interactional occasion, with respect to the most frequently used type of elliptical construction. It therefore appears that there is not only a variation in strategies that depends on who the healthy conversational partner is, as suggested in the 1997 Annual Report, but also considerable variation across episodes.

5.2.2 Case study of an Arrernte-English bilingual aphasic

Wilkins continued his longitudinal research into the post-stroke 'recovery' of an Arrernte-English bilingual aphasic (see Annual Report 1997). At the age of 48, in 1991, MH suffered a left temporo-fronto-parietal region CVA, resulting in right hemiplegia and severe apraxia of speech. MH was later categorized by speech pathologists as a Broca's aphasic on the basis of her spoken and written English (although no formal tests were carried out). The case is special for several reasons:

- a) She is an Australian Aboriginal whose first language is Arrernte (Pama-Nyungan, Australian);
- b) There is extensive pre-stroke data from her;
- c) There is now post-stroke data covering a 7 year-span (much of it video-tape of natural interactions);
- d) We have full medical details including a CAT-scan showing her lesion site; and
- e) Prior to her stroke, MH controlled at least seven modes of communication.

These pre-stroke modes of communication were: spoken Arrernte (dominant language), spoken English (second language), an auxiliary sign language (i.e. a traditional form of manual sign), sand drawing (a

traditional graphic form of representation - see Annual Report 1997), gesture, written English, and written Arrernte. One obvious question for examination was: How are MHs pre-stroke modes of communication used post-stroke? This broad question itself presupposes a number of more specific questions: Have all modes been affected by her stroke? Has there been a reallocation of functional load? Has her post-stroke pattern of communication stabilized or continued to change?

As an example, we can ask these questions with respect to her gesture behavior. Typically, Arrernte speakers do not produce more than one gesture per multi-word clause. In the early years post-stroke, however, MH would commonly convey messages by uttering a single word while using a complex of clarifying gestures. The severity of the apraxia of speech made it difficult to utter more than one syllable, let alone multi-word clauses, and so gesture (and other visual modalities, such as sign, sand drawing, and written English) tended to convey much more of the content of a message than is typical. However, her speech, especially her English, has slowly shown improvement, so that she can now more readily produce multi-word utterances. In the post-stroke period, MH has reduced her rate of gesture eight-fold from a gesture-to-speech ratio of approximately 4 gestures for every 1 word to a ratio of approximately 0.5 gestures for every 1 word. The character of her gestures has also changed, from carrying the major content of the message in the early phase to carrying much less content in the later phase. So, unlike speech, gesture was not affected by MHs stroke, and remained available for increased use in interaction, but the functional load has been shifting slowly back in the direction of the pre-stroke norm as speech production (in English) has improved. We have not yet witnessed a period of stabilization. A rough overview of how all her modes of communication have fared during the period of research is given in Table 1.

Pre-Stroke Modes of Communication	Early years post-stroke [1992-1994]	Current Situation [1997-1998J]
<i>Spoken Arrernte</i> (dominant language) [N.B. Arrernte phonology typologically atypical]	No significant use of Arrernte apart from few key vocabulary items.	Still very little used, has shown only marginal improvement. No spontaneous multi-word utterances.
<i>Spoken English</i> (second language) N.B. English phonology relatively less complex]	Began with single mono syllabic word utterances, improving to small two word utterances, and very few multi-word utterances. Some agrammatism.	Now the dominant communication mode. Communicates in (effortful) multi-word utterances. Very few agrammatic features.
<i>Auxiliary Sign Language and Hand Signs</i>	Extended regularly into contexts where not normally used. MH expanded sign inventory.	Still used in some contexts where not normally used.
<i>Sand Drawing</i>	Extended regularly into contexts where not normally used. In normal contexts of use, augmented by sign even where speech expected.	Now only used in standard contexts, but remains primarily paired with sign, not speech.
<i>Gesture</i>	Carried a much higher than normal functional load in interaction.	Although still higher than normal, the functional load has significantly reduced
<i>Written English</i>	Used extensively in face-to-face interaction. Like speech, -showed agrammatic features. Also used as tool to 'get sound of word' and aid pronunciation. [N.B. used word boards and Canon communicator)	Back to normal. No longer used in face-to-face interaction or as a support to speech production.
<i>Written Arrernte</i>	No significant use.	Has improved significantly, but is not used as much as it was pre-stroke.

Table 1: Overview of MH's use of pre-stroke modes of communication during post-stroke 'recovery'

6 GESTURE

The Gesture project continued the investigation of the temporal and informational coordination between speech and (iconic and deictic) gestures that spontaneously accompany speech (henceforth, simply 'gesture'). Studies carried out by the project indicate that gestures are generated from interface processes between spatial thinking and speaking.

In a study reported in the 1997 Annual Report, Kita and Özyürek found that the gestural representation of motion events cross-linguistically parallels the variation in how speech packages different components of a motion event. This parallelism indicates that gestures are generated from the Interface Mechanism, namely the mechanism that pre-processes spatial information to make it more encodable within a speech formulation cycle that generates an utterance. (The Interface Mechanism can be subsumed under Conceptualizer of Levelt's Speech Production model).

In 1998, Özyürek and Kita further investigated the Interface Mechanism, particularly how cross-linguistic differences in the lexicalization of motion events influences the informational coordination between the concurrent speech and gesture (6.1).

A further question arises about how gestures are involved in the Interface Mechanism. One possibility is that gestures are a mere externalization of the representation in the Interface Process (Passive Involvement Hypothesis). Another possibility is that gestures play an active role in the Interface Process and influence the generation of representation in the Interface Mechanism (Active Involvement Hypothesis).

Kita's study (6.2) on the body movements associated with utterances with the words 'left' and 'right' supports the Active Involvement Hypothesis. There is evidence that gestures help choose between notoriously confusing concepts, LEFT and RIGHT. Alibali, Kita, and Young's study (6.3) provides further support for the idea that the generation of gestures is associated with the conceptual planning for speaking rather than the formulation of speech.

De Ruiter defended his dissertation in 1998 and continued to be one of the main members of the Gesture project as a post-doctoral fellow. He proposed that gestures are generated from the Conceptualizer. Furthermore, he proposed that the production of gestures are 'ballistic' (i.e. not temporally coordinated with speech formulation processes). De Ruiter and Wilkins' study found cross-cultural evidence for the ballistic theory (6.4).

The general picture that emerges from the above studies is that gestures are actively involved in the speech planning process, where the content of the following utterance is determined. However, there is little coordination (either temporally or informationally) between the speech formulation process and the gesture execution.

6.1 Cross-linguistic differences in the distribution of semantic information in speech versus gesture: English, Turkish, and Japanese

Özyürek and Kita continued to investigate the effects of linguistic structure on iconic gestures that accompany speech, comparing three languages, English, Turkish, and Japanese. Turkish and Japanese differ from English in the lexical and clausal packaging of motion events, especially in those of manner and path. The English description of manner and path requires only one verb with a satellite, *rolls down*, whereas both Turkish and Japanese require two verbs. In Turkish, for example, the phrase would be *yuvartlanarak iniyor* 'rolling descends' or *yuvartlanarak gidiyor* 'rolling goes'. The previous study (Annual Report 1997) investigated whether these different linguistic packaging strategies would influence gestural representations. Verbal and gestural descriptions of one motion event scene that included both manner and path were compared across speakers of three languages. Turkish and Japanese speakers, compared to English speakers were more likely to produce (a) pure rotation gestures (representing Manner-only), and (b) pure trajectory gestures (representing

Path-only). Thus, the way gestures represented components of motion events paralleled the lexicalization patterns in different languages.

The way that motion event representations differed in both speech and gesture had further consequences for how semantic information was distributed into concurrent speech and gesture. In Turkish and Japanese, what is represented in each gesture did not always parallel what is represented in its accompanying clause, as seen in this Turkish example:

- (1) Speech: (clause 1): *yuvatlanarak*'rolling'
 Gesture: pure trajectory (Path-only)
 Speech: (clause 2): *gidiyor*'goes'
 Gesture: pure rotation (Manner-only)

That is, information distributed into speech and gesture within each speech-gesture unit was complementary rather than parallel. In contrast, in English, what is expressed in each gesture paralleled what is expressed in its accompanying verbal clause (Speech: *rolls down*, Gesture: pure trajectory).

This difference in the distribution of manner and path information in concurrent speech and gesture suggests that languages put different demands on the Interface Mechanism. It is plausible that the Japanese and Turkish languages put a bigger cognitive load on the Interface Mechanism than English. Turkish and Japanese speakers have to decompose two aspects of a motion event, namely manner and path, and hold them in working memory until they are expressed in two separate units in speech formulation. More frequent informational mismatch in concurrent speech and gesture in Turkish and Japanese suggests that the extra load may lead to the 'misfiring' of gestures.

6.2 Gestural facilitation of access to the concepts LEFT and RIGHT

Kita investigated the role of gestural body movement in speaking. It was argued that the gestural body movement to the left and to the right primes access to the concepts LEFT and RIGHT, respectively, in the course of speech production. Evidence comes from naturalistic route directions recorded in Tokyo. Informants were recruited on the street in their familiar environment. They gave directions to two target locations, which were about 400 m away. The direction of turns on the routes was indicated by the words, *migi*'right' and *hidari*'left', or by reference to a local landmark

(e.g. 'to the Red Gate'). The gestural indication of turn direction can be classified into three types in terms of the frame of reference used: absolute, relative (see Annual Report 1994), and dual. The dual type is the case where the informant's body is aligned to the leg of the route that leads up to the turn; thus, the gestural indication of the direction is correct in both absolute and relative frames of reference.

It was found that the absolute-type and the relative-type have different gestural morphology. In absolute-type gestures, the hand is raised higher and the movement is more expansive than relative-type gestures. The gestural morphology of the dual-type gestures patterned with absolute-type gestures, indicating that the mental processes for the production of these two types of gestures are the same. It was also found that the dual-type selectively occurs when informants use the word 'left' and 'right' to linguistically indicate the turn direction (but not when they use a local landmark). This suggests the following course of events. As a preparation for uttering 'left' or 'right', informants rotated their torsos into the position for a dual-type gesture and then produced an absolute-type gesture. The direction of the gestural body movement was translated into the relative concept LEFT or RIGHT, thus facilitating the utterance containing the word 'left' or 'right'.

6.3 The role of gesture in micro-conceptualization for speaking

Alibali, Kita, and Young investigated the function of gestures in the speech production process. This study contrasts two hypotheses regarding speaker-oriented functions of representational gestures (i.e. iconic and deictic gestures). The first hypothesis states that gesturing helps linguistic formulation processes of speaking. The second states that it helps micro-conceptual planning of speaking (i.e. figuring out how to package rich information into a unit that has the appropriate informational complexity for a single utterance). English-speaking five-year-old children were tested in two conditions that were equivalent in linguistic difficulty, but differed in the difficulty of conceptual planning. In one condition, children were asked to give an explanation to their response to Piagetian conservation tasks. In the other condition, the children were asked to describe the end state of the object manipulation in the same conservation tasks. Children's linguistic responses in the two conditions were very similar. However, children produced more representational gestures per clause in the explanation condition than in the description condition. Thus,

representational gestures evidently facilitate micro-conceptual planning, which is more crucial in the explanation task than in the description task.

6.4 Arrernte - Dutch comparison of speech - gesture synchronization and gesture space

De Ruiter and Wilkins investigated the assumption that the synchronization between gesture and speech is a cross-cultural universal, as is implicitly assumed in most of the literature on synchronization.

To this end, they analyzed naturalistic video recordings of four Dutch and four Arrernte speakers. These speakers were all elder members of their respective communities and were, at the time of recording, situated in, and speaking about, the surroundings they had lived in most of their lives.

This study limited itself to so-called 'spatial' gestures. These are gestures that refer to locations, areas, directions or trajectories in the (non-visually available) physical space around them. There were 80 of these Dutch gestures in the analysis and 100 Arrernte gestures. Gestures were coded to be either 'obligatory' or 'supportive'. Obligatory gestures are gestures that are required in order for the accompanying speech to be semantically and pragmatically coherent, whereas with supportive gestures, the accompanying speech is comprehensible without access to gesture.

A number of features, such as handedness of the gesture, the presence of place-names in the speech, and deictic expressions in the accompanying speech were coded. For every gesture, the *affiliate*, the part of speech that maximally corresponds with the meaning of the gesture, was identified. For every gesture/speech fragment, the beginning of the preparatory hand movement, the beginning of the *stroke* (meaningful component) and the end of the stroke were located in time using MediaTagger (a digitized-video analysis software developed at the Institute). Using the waveform editor of Media Tagger, the beginning and the end of the vocalization of the affiliate were also located in time.

The most noteworthy results were as follows. First, it turns out that Dutch and Arrernte speakers use a different hand allocation strategy. Dutch speakers tended to use only one preferred hand (usually the dominant hand) and so used it for both contralateral and ipsilateral targets, whereas Arrernte speakers used both hands and only ipsilateral gestures. In Arrernte, the location of the target on one or other side of the body dictates which hand is used.

Second, the claim of Levelt, Richardson & La Heij as well as De Ruiters (1998) that obligatory gestures are more tightly synchronized with speech than supportive gestures was proven to be wrong in naturalistic speech. Both for the Dutch and the Arrernte data, the temporal correlation between gesture and speech was significantly higher for the supportive gestures. This could be a consequence of the more transparent semiotic relation between obligatory gestures and the deictic speech, making it less vital to synchronize than for supportive gestures. With the latter category, the relationship between the gesture and the speech is less obvious, making the communicative need for temporal overlap higher.

Third, the *gesture space* used by the Arrernte speakers turned out to be much larger than for the Dutch. Arrernte gestures are 'wider' and more extended than Dutch gestures (cf. Levinson's analysis of Guugu Yimithirr and English).

A fourth analysis concerned the cross-linguistic comparison of the temporal synchronization. The claim by McNeill that the onset of the preparatory phase of the gesture precedes the affiliate, but that the stroke of the gesture overlaps with the affiliate was confirmed for both Dutch (84% of the gestures) and Arrernte (80% of the gestures).

The larger gesture space in Arrernte gesture also led to an average preparatory phase duration that was 244 msec longer than for the Dutch data. This enabled a direct empirical test of two competing theories of gesture speech synchronization. The Growth Point theory of McNeill predicts that if the preparatory phase of a gesture is longer, the affiliate should adapt, i.e. appear later in the speech stream. However, the ballistic theory by Levelt and colleagues, embedded in a model by De Ruiters (1998), predicts that since there is no interaction between gesture and speech processes after the planning phase, the affiliate should be unaffected, thereby increasing the asynchrony between gesture (stroke) onset and affiliate onset. Analysis revealed not only that the prediction of the ballistic model was correct, but also that the resulting asynchrony was of the same duration as the lengthening of the preparatory phase. These results strongly support the ballistic model. Cross-culturally, there are real differences in hand allocation for spatial gestures. There are also superficial timing differences between the two languages, but it turns out that they are the result of a cultural difference in the gesture space in combination with the same synchronization mechanism.

7 SPACE

The Space project investigates the nature of spatial parameters in natural languages and their relation to non-linguistic spatial cognition. In this summary of the 1998 research activities, we report on results of joint research on the semantic extension of 'Basic Locative Constructions' cross-linguistically and on first results of our analyses of demonstrative systems in a number of geographically and genetically distinct languages. Moreover, we continue our reports on the the issue of 'Frames of Reference' (FoR) with the presentation of results on the acquisition of the local-landmark-based absolute system in Marquesan and with a discussion of the importance of FoR for Nicaraguan Sign Language. Also, we report on the investigation of first language acquisition of topological semantic categories in Dutch and English.

7.1 The semantic extension of basic locative constructions cross-linguistically

The work reported in this section is an extension of prior work on Topological Relations. In particular, it uses data elicited with the aid of Bowerman's Topological Relations Picture Series (see Annual Report 1992 and 1993) to explore the nature and semantic extension of basic locative constructions cross-linguistically. As such, this is a collaborative project involving fieldwork by 11 researchers working on a diverse range of genetically and geographically distinct languages. The languages and researchers are shown in the following table:

<i>Language</i>	<i>Name/Language Family</i>	<i>Researcher</i>
Arrernte	Pama-Nyungan, Australian	Wilkins
Dutch	Germanic, Indo-European	Haak (& Wilkins)
Inuktitut	Eskimo-Aleut	Allen
Japanese	Unknown	Kita
Kilivila	Austronesian (PNG)	Senft
Likpe Kwa	Niger-Congo (Ghana)	Ameka
Oluta Popoluca	Mixe-Zoquean (Mexico)	Zavala
Marquesan	Oceanic, Austronesian	Cablitz
Rössel (YeT Dnye)	Isolate (PNG)	Levinson
Turkish	Turkic, Altaic	Özyürek
Tzeltal	Mayan (Mexico)	P. Brown

This work begins with the assumption, common in typological linguistics, that it is possible to identify a Basic Locative Construction (BLC) in a diverse range of unrelated languages. For the sake of simplicity, we can say that, very roughly, a BLC would be the typical construction selected by speakers of a language to answer a where-question like 'Where is the cup?'. If this question is asked in relation to a picture of 'a cup on a table', for instance, then a typical answer in English would be 'The cup is on the table', and this would be a particular instance of the BLC for English (which has the schematic form: Figure be+tense preposition Ground). An existential construction like 'There is a cup on the table' would not be a BLC, despite some locative semantics, since it cannot naturally answer the where-question, and so is functionally distinct.

Each researcher identified the BLC for the language that they work with, and a comparison of the construction forms revealed that BLCs fell into three distinct typological groups.

'General verb languages' are those in which the BLC typically contains a single general verb, often glossed 'exist', 'be' or 'copula', but also sometimes glossed as a general use of a specific locative verb. Languages of this type were: Inuktitut, Japanese (with 2 verbs, whose choice varies according to the animacy of the subject), Kilivila, Marquesan, Oluta, and Turkish.

'Postural verb languages' are those in which there are three or four different verbs which occur in the verb slot of the BLC, and the choice of verb may depend on figure-oriented information such as whether, in the

verb may depend on figure-oriented information such as whether, in the particular locative scene, the figure is 'sitting' or 'standing' or 'hanging'. However, the primary coding of information about the topological spatial relationship between figure and ground remains expressed in a category outside the verb (like an adposition), just as with 'general verb languages'. Languages of this type include: Arrernte ('sit', 'stand', 'lie'), Dutch ('sit', 'stand', 'lie', 'hang') and Rossel/Yel? Dnye ('sit', 'stand', 'hang' (see Annual Report 1997)). So, where the BLC of a 'general verb language' like English is basically showing a single categorizational treatment of the scene, related to preposition selection, the BLC of a language like Dutch requires two essentially independent categorizations, one related to preposition selection and one related to verb selection.

'Multi-verb languages' are those in which there is a wide range of verbs, around 10 or more, occurring in the verb slot of the BLC. These verbs often code specific information about the locative relation - information of a type which is coded in adpositions, for instance, in languages of the other two types. Thus, as a set, these verbs are not so specifically concerned with the internal configuration of just the figure. Languages of this type include: Likpe (9 verbs) and Tzeltal (about 40 frequently used verbs, but the class is large). From the point of view of how information gets distributed, it is interesting to note that both of these languages have highly general adpositions that do little more than signal that there is some type of locative relation, typically leaving it to the verbs to specify the nature of the relation.

Having identified which are the relevant constructions to bring into comparison, we can now ask: Is the range of scenes (situations) which 'basic locative constructions' are used to describe ('categorize') semantically similar or semantically divergent across languages? In order to answer this question, we have compared the descriptions for the 59 scenes (out of a total of 71) in the Topological Relations Picture Series (developed by Bowerman and Pederson, now at U. of Oregon) that depict the location of an inanimate figure. On the basis of distinct grammatical treatments in the context of the elicitation task, we can identify six different clusters of these scenes, as shown in the selection in Figure 1. The ordering of these clusters is based on the fact that, where the same distinct functional and grammatical treatment is used for more than one cluster of scenes, it will apply to adjacent clusters.

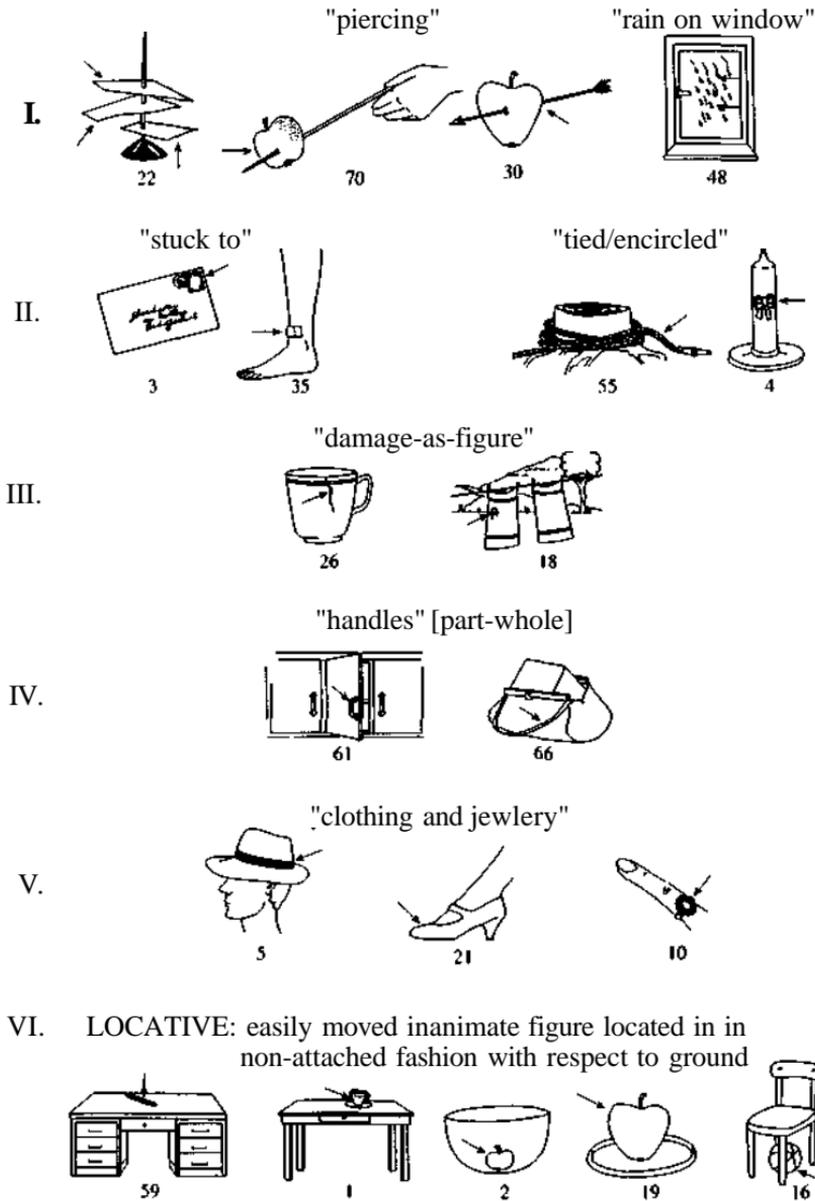


Figure 1

Now, when we consider the BLC in relation to these six clusters, we find that the 11 languages differ dramatically in the range of scenes which they can apply their 'basic locative construction' to, but they vary in a principled fashion. All the languages agree on a core set of scenes for which their 'basic locative construction' is employed [cluster VI], and then there is a hierarchy of further scene types along which the languages can be arrayed depending on how far a given language can extend its BLC. The results can be diagrammed as follows (the numbers refer to the pictures in Figure 1).

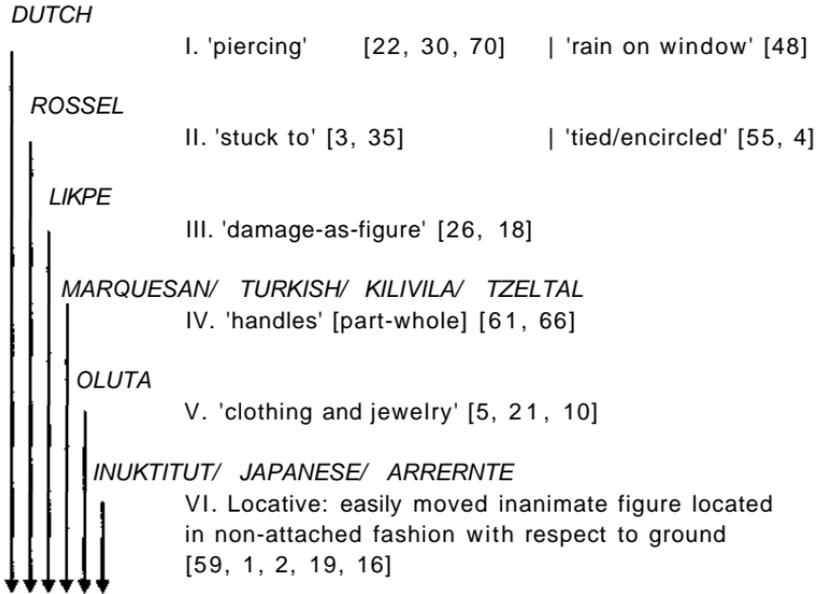


Figure 2: Typological cline for the application of a language's BLC

In Figure 2, below the cut-off points, the majority of a language's speakers apply the language's 'basic locative construction', while above the cut-off points they tend to apply other grammatical constructions (even when a 'where-question' has been asked). So, the newsworthy result is NOT that all languages can be shown to use their BLC to describe the scenes in cluster VI where an easily moved inanimate figure is located in a non-attached fashion with respect to a ground object - this was to be expected given the work and presumptions of previous researchers - but, instead, the news is that there appear to be predictable (typological) constraints on the semantic range of application of BLCs cross-linguistically, leading to an implicational hierarchy of 'better-to-worse' locational scene clusters (i.e. VI-to-I in Figure 1).

On the basis of these findings, Ameka undertook more focused research and compared the expression of spatial topological relations in two languages in contact: Ewe and Likpe (Kwa, Niger Congo, Ghana). Ewe is the dominant lingua franca in the Likpe area. There are similarities as well as significant differences between the two languages in the way static locative scenes are described. In both languages, there is a division of labor in packaging spatial information between the elements in a locative construction. However, the details of the distribution vary:

- (1) Both languages are similar in using spatial region terms, designated postpositions, such as Ewe *dz* 'upper surface' or Likpe *a-suS* 'surface' to code the search domain information (see example below).
- (2) Locational predication is packaged in a single locative verb in Ewe. In Likpe, on the other hand, the coding of locational predication is shared between a set of nine contrasting spatial configurational verbs and a general locative preposition. In terms of the typology of basic locative constructions introduced above, Ewe is a 'general locative verb language' while Likpe is a 'multiverb language'. Thus a spatial scene described in English as *The cup is on the table* is expressed in Ewe as

K5pu lä le kplö -a dzi
 cup DEF be_at:PRES table-DEF upper surface

lit: The cup is located at the table's upper surface'

and in Likpe as

K5pu	8-me	tek-e	li	opunu	(a-sue)
cup	AGR-DET	V	LOC	table	SURFACE

lit: 'The cup makes contact with the flat surface of the table.'

- (3) The two languages differ in whether the coding of the different types of spatial information is obligatory. In Ewe, both the relational and ground information are obligatory except when the reference object is a toponym, a locative nominal associated with a customary activity, an activity nominal understood as representing a place, or a nominal that contains a postposition in its composition. In Likpe, on the other hand, ground information is 'less obligatory'. Given sufficient context and conventional understandings about the reference object, there is less interest in the specification of the search domain; hence the optionality of the postpositions in sentences like the one above in Likpe, which are obligatory in Ewe'.

7.2 The construction of topological semantic categories of space in first language acquisition

In previous research, Bowerman and her colleagues showed that children use and comprehend language-specific semantic categories of space by a remarkably young age - between 18 and 24 months. This work has challenged the traditional view that children initially map spatial words onto a small set of universal spatial concepts as these become available through nonlinguistic cognition, and suggests instead that learners can construct semantic categories by observing how space is classified in the input language. Using previously collected data, Bowerman has been exploring the mechanisms driving the construction process.

Together with Gentner (Northwestern U.), Bowerman investigated whether some ways of classifying space are more 'natural' for children than others. Appeals to 'naturalness' are often circular: children are claimed to learn something more easily because it is more natural, but the evidence for naturalness is that children learn it more easily. As an independent guide to naturalness, Bowerman and Gentner propose relying on the extent to which languages agree in their semantic classification of a domain. Strong cross-linguistic agreement suggests uniformity in the way human beings conceptualize the domain nonlinguistically, whereas disagreement suggests that the domain is open to alternative conceptualizations.

Bowerman and Gentner hypothesized that cross-linguistically common spatial semantic categories should be learned more quickly and with fewer errors than rare ones. Drawing on a cross-linguistic study by Bowerman and Pederson (U. of Oregon) of how adult languages classify so-called 'topological' static spatial situations (Annual Report 1992), Bowerman and Gentner formulated detailed predictions about the acquisition of a set of spatial prepositions in English (whose categories are common) and Dutch (which has a couple of rare categories), and tested them against data they had collected earlier in an elicited production experiment with English- and Dutch-speaking children age 2;6 - 6 years (see Annual Report 1987). The predictions were strongly confirmed; e.g. Dutch children had particular difficulty with the cross-linguistically rare categories and their errors (overextensions) reflected cross-linguistically more common ways of classifying.

Analysis of error patterns from a second elicited production study that Bowerman conducted together with Choi (San Diego State U.) with learners of English, Dutch, and Korean (Annual Report 1992, 1993) revealed additional factors that shape the contours of children's early spatial categories: certain kinds of polysemy, the density of words in a semantic domain, and the positioning of core members of a category. The first two of these are illustrated briefly.

Adult speakers of both English and Dutch make a systematic distinction between actions of 'removal from containment' ([take] *out* / *uit* 'out') and 'removal from surface contact' (*off* / *af* 'off'). English-speaking children master this distinction between 2;0 and 2;5 years. Dutch children, however, massively overextend *uit* 'out' to actions of both kinds. Why do the two sets of children differ? In Dutch, but not English, the 'out' word has an important spatial use that goes against its canonical meaning: it specifies the removal of enveloping clothing (e.g. *trek je jas uit* 'take your coat out' [=off]). For Dutch adults, the clothing use seems to be stored as a separate sense. But young Dutch learners apparently try initially to construct a single meaning for *uit* that encompasses both removal from containment and removal from the body. The only meaning consistent with both uses is 'removal' itself, which sanctions the use of *uit* for taking objects off surfaces.

Children learning English overextend *open* to many acts of separation, such as unhooking toy train cars. In contrast, children learning Korean do not overextend *yelda* 'open'. This difference can be traced to the way the

two adult languages classify acts of 'opening'. English *open* is a very large category, while Korean breaks 'opening' actions down into about six categories on the basis of distinctions in the physical properties of the objects acted on. Bowerman and Choi propose that when children hear actions involving many different kinds of objects referred to with the same word, they often fill in the gaps between observed referent events along a potential generalization gradient and create a broad category that may overshoot the mark. When they hear these same events distinguished systematically by different words, however, the impulse to generalize is checked.

7.3 Demonstrative systems

In many ways, there seem to be two fundamentally different kinds of demonstrative systems: (1) speaker-centered ones, with some kind of pragmatically-sensitive metric of distance from the speaker, and (2) speaker- versus addressee-based systems (so that one has a demonstrative often glossed as 'near me' versus another for 'near you'), where contrast in distance may be less relevant than features like shared focus of attention. Thus the presence of an addressee-based deictic may fundamentally restructure a demonstrative system.

7.3.1 Kilivila

Kilivila has a speaker-centered system of demonstratives. In 1998 Senft elicited further data on spatial deixis by asking his consultants (adults and children) to play a game that actually had its local equivalent on the Trobriands where the language is spoken. This game is called *nene'i nene'i kora* (find, find the hidden), and it is usually played by two children. One player chooses an object in their joint environment and asks the other player to identify this object, which is only characterized as a 'thing' with a certain colour or as being close to a certain object or place. This game certainly helps children learn the deictic forms of their mother tongue. The analyses of these data and of data gathered earlier both in actual speech and with questionnaires developed by Pederson, Wilkins, Levinson, and Senft, reveals the following ten observations.

- 1) Kilivila has two sets of demonstratives. One set obligatorily requires deictic gestures, while the other set needs the incorporation of classifiers in the word formation of its forms; these classifiers provide the addressee with additional information that further specifies the search domain for the referent of the respective demonstrative (see

Annual Report 1996). The two sets have proximal, medial, and distal forms. They are speaker-centered, but the deictic reference can be modified by additional morphemes that add additional distinctions to this 'default' understanding.

- 2) The proximal forms of the demonstratives are semantically unmarked; they are used most often and have the widest spatial distribution.
- 3) The use of the medial forms is not restricted to situations where there are three referents to distinguish. Speakers may only use the proximal and medial forms to distinguish between referents that are in medial and distal positions. However, if speakers want to refer to something that is really far away or invisible from their present position, and they want to mark this fact, they use the distal forms. If they want to refer to their own body-parts contrastively, they may use the proximal and the medial but not the distal forms.
- 4) When there are more than three referents that have to be deictically distinguished, only the ones closer to the speaker will be distinguished as being proximal or medial; the further ones are lumped together as distal and additional modifiers are employed to make the deictic reference as unequivocal as possible.
- 5) In their deictic references, speakers can take the position of other participants in the speech situation into account; they can shift their 'origo'.
- 6) Speakers use their distance-based systems not only on the 'away' axis, but also on the left/right axis.
- 7) It seems that the spatial distinctions 'proximal/medial/distal' invoke spatial regions; each object introduces a partition of space so that one object introduces two spaces, two objects introduce three spaces, etc.
- 8) If there is no distance contrast between two referents, but the speaker wants to differentiate them, the proximal and medial forms can be used for this purpose; the order in which the forms are used is arbitrary. If there is a distance contrast between referents, this contrast is explicitly expressed.
- 9) In the vertical dimension, the Kilivila system is organized around the speaker's torso. The proximal forms are used to refer to referents at a 'chest-belly-head' level, the medial forms refer to referents at the

speaker's feet and above his or her head. The distal forms are used rather rarely here; they point to referents that are really far below or high above a speaker.

- 10) In space beyond table-top space, speakers seem to prefer the use of both sets of demonstratives. The forms from the two sets can, but need not, agree with respect to their position within the proximal-medial-distal series. The first form used usually expresses the spatial distinction, whereas the second form quite often seems to just keep the addressee's attention focused on the spatial area marked by the first form.

7.3.2 Turkish

Turkish and Japanese are two languages which pose a problem for straightforward differentiation of speaker-centered and speaker- versus addressee-based systems. Özyürek analyzed the meaning of the modern Turkish demonstrative pronouns, *bu*, *su*, and *o* based on their usage in natural, face-to-face conversational discourse. In the literature, two contradictory claims are made with regard to whether the three-way Turkish system can be characterized as a *speaker-based system* or as an *addressee-based system*. According to the *speaker-based system* account, *bu* is used for objects close to the speaker, *su* for objects in mid-distance away from the speaker, and *o* for objects which are furthest away from the speaker. However, according to the *addressee-based system* account, *bu* is used for objects close to the speaker, *su* for objects close to the addressee, and *o* for objects away from both the speaker and the addressee.

Özyürek investigated which account would explain how speakers used these three demonstratives in natural conversational discourse. The data analyzed came from a videotaped painting class (in Istanbul, Turkey) where a teacher and students discussed multiple paintings on display in front of them. The analysis showed that none of the previous accounts could explain the actual use of the demonstratives. Speakers used the demonstrative *su* to introduce a new referent in the spatial context of the utterance or to shift the addressee's focus of attention to an object *regardless* of where the referent was *spatially located* in relation to either the speaker or the addressee. However, the objects referred to with *bu* or *o* had to be already introduced within the extra-linguistic spatial context of

the utterance. Once introduced, *bu* was used for objects close to the speaker and *o* for objects away from the speaker.

This analysis shows, first of all, that Turkish speakers have to take into account the addressee's knowledge status or focus of attention in order to choose among the demonstratives (i.e. *su* versus *bu* or *o*). Secondly, it questions the general assumption that the basic meaning of demonstratives is spatial. Lastly, it shows that the traditional categories of 'speaker-based' versus 'addressee-based' systems need to be redefined in order to take into account demonstratives with non-spatial meanings.

7.3.3 Japanese

Kita investigated the functions of the near-the-addressee demonstrative in Japanese. The Japanese demonstrative system has a three-way distinction (*kore*, *sore*, and *are*). In the literature, *kore*, *sore*, and *are* are analyzed respectively as 'near the speaker', 'near the addressee', and 'far from both the speaker and the addressee'. A video-recording of actual use of these terms in conversation was analyzed, with special attention paid to forms of non-verbal behavior such as pointing gestures and gaze and posture shift. It was found that *sore* is used not only to refer to a referent near the addressee, but also to draw attention to a referent which is in the vicinity of the speech event but not closer to the addressee than to the speaker. This second usage is similar to the functions of *su* in Turkish. However, unlike Turkish *su*, the use of *sore* is blocked by distance-based conditions. Namely, *sore* cannot draw the addressee's attention when the referent is very close to the speaker (e.g. the speaker's clothing) or very far from the speech event (e.g. a star in the sky).

7.3.4 Y6T Dnye

Levinson studied the demonstratives of Yel? Dnye, the language of R6ssel Island. These demonstratives are clearly basically based on the speaker, but there is also an addressee-based deictic, which nevertheless fails to have systematic effects on the rest of the system. The demonstratives seem all to be adjectival, rather than pronominal, so one says e.g. *ala tpile* 'this thing' or *ala n:ii* ('this one' where *n:ii* is a pronominal) rather than just *ala* 'this' (although in elicitation circumstances one can get the plain *ala* as an ellipsis). The full inventory is complex, with special anaphoric and cataphoric forms, but the core is as follows (this usage set may in fact reflect the conflation of more than one system, since e.g. *mu* also

contrasts with another deictic *yi*, when used anaphorically, meaning 'the other' versus 'this one', respectively):

	Speaker-Based	Addressee-Based
Proximal	<i>ala</i>	<i>ye</i>
Medial	<i>kt</i>	–
Distal	<i>mu</i>	–

The speaker-based series is clearly flexible about relative distance - all terms (including the distal) can all be used in table-top space or, alternatively, to refer to large scale, e.g. to a string of villages. The addressee-based deictic is just an optional alternative, usually an alternative to the distal speaker-based deictic when the referent happens to be close to the addressee. In this way, the Rössel system is fundamentally unlike, say, Japanese or Turkish, where the whole system seems to hinge around the possibility of the use of the addressee-based term. The only special peculiarity of the Rössel speaker-based series is that the sequence is determined by distance from speaker only when objects to be contrasted are in a radial alignment from the speaker on the horizontal plane. If the referents are, e.g. in a line across the field of view, then the sequence can begin with the proximal deictic even if it is, e.g. the farthest away to the left or right. This property is a reminder that serial order of mention can be an important ingredient in the choice of a demonstrative.

7.3.5 Taba

Bowden studied the Taba deictic system and found a particle *ya*, used by speakers to point to referents they presume that their addressees know about. *Ya* is 'defective' as a demonstrative, however, since it does not enter into common morphological paradigms with other demonstratives. Its lack of ability to appear in derived forms can be attributed to the fact that the derived forms are all used for referents that are either visible or anaphorically retrievable and *ya* is only used for first mentions. The ability to occur in common morphological paradigms cannot be used as a defining criterion for demonstratives.

7.4 The acquisition of the Marquesan absolute frame of reference system

Cablitz continued her first language acquisition project on spatial expressions in Marquesan (Austronesian, French Polynesia; see Annual Report 1997). The research in 1998 mainly focused on the acquisition of the local-landmark-based absolute FoR system of Marquesan, which has one main SEA/INLAND axis and an undifferentiated orthogonal ACROSS axis. Data from 4- to 8-year-olds were gathered by having children perform an interactive object-object matching task in familiar and unfamiliar surroundings. The data suggest that a basic understanding of Marquesan absolute locatives in small-scale spatial arrays is acquired between the ages of 4 and 5. The familiarity of the environment seems to play a role in successfully identifying absolute directions. At 4, children could not reliably identify absolute directions even in familiar surroundings. Five-year-olds had a good comprehension of absolute locatives in familiar surroundings; in unfamiliar surroundings their comprehension was still basically good, but they often extended the interpretation of the absolute locative 'inland' in a non-adultlike way. Non-adultlike interpretations of 'inland' in unfamiliar surroundings could be observed well up to the age of 8.

Non-adultlike interpretations of 'inland' are not random: there is a clear tendency to extend the absolute locative 'inland' to the ACROSS directions. A possible explanation is that children infer the meaning of absolute locatives according to the geophysical constitution of the environment. Marquesans live in a valley in which the land rises steeply and steadily from the coast towards the interior of the island; this also holds for the ACROSS directions of a Marquesan valley. To get oriented, children apparently use perceptual clues (inclination of the land) to infer where 'seaward' and 'inland' are.

7.5 Frames of Reference in Nicaraguan Sign Language

Senghas examined newly-developing devices in Nicaraguan Sign Language (NSL) for expressing the location and orientation of objects. NSL is a rich source of data on spatial and locative language for two reasons: first, being a signed language, it expresses three-dimensional physical space in the signing space, which too is physical and three-dimensional; and second, being a young language less than two decades old, it has grammatical devices still in the early stages of development.

Newer devices are most prominent in the youngest members of the community.

Several features have emerged in NSL for indicating the location and orientation of objects. These include the location in which the signer produces a sign in relation to the body, the orientation of the hands, and the direction of movement produced within a sign, for example, to one side, or backwards.

For successful communication, these devices must be equivalents mapped by signer and addressee to a spatial framework. In particular, the two interlocutors must share the same system with respect to frame of reference and with respect to the perspective taken, such as that of the signer, the addressee, or the character discussed. Furthermore, they must share the way in which the spatial locations of signs are translated, or mapped, to physical spatial locations in the world.

Both older and younger Nicaraguan signers tend to use a relative frame of reference, predominantly from the signer's perspective. However, any given spatially-marked sign is still uninterpretable until a sign-space to physical-space mapping has been explicitly negotiated. Interestingly, only younger signers are capable of negotiating this mapping, despite the fact that they have had fewer years of experience with the language. This development may be a linguistic one, or a conceptual one, in the younger generation. In either case, it is clearly linked to their command of a more spatially-developed language.

8 THE ACQUISITION OF SCOPE RELATIONS

The goal of this project is to gain insight into how children develop the skills to analyze the semantic and syntactic composition of sentences, skills needed for the interpretation of the linguistic input they are exposed to. The major concern is the study of the acquisition of those elements in a sentence which take scope over other elements. Scope taking elements appear to be central clues to the structure of a sentence guiding the semantic interpretation of that sentence. Therefore, not only is the *lexical* meaning of these elements of interest but also in particular, what sorts of *structural* relations they bear to other elements in a sentence. The phenomena considered for investigation are the scope properties of temporal adverbials and finiteness (8.1 and 8.2), the scope behavior of focus particles (8.3), and scope-related aspects in the interpretation of nominal expressions.

The notion of the 'structure of a sentence' should not be understood as 'phrasal constituent structure'. The study of scoping elements shows that subphrasal, morphosyntactic, and sublexical structure plays a crucial role as well. Given its importance in the study of focus particles, the prosodic structure of a sentence is also considered an additional piece of structural input relevant for semantic interpretation.

The project is *cross-linguistic* in perspective so that the important question of to what extent scope relations are language-universal can be addressed. In addition to syntactic variability, a cross-linguistic perspective may lead to exploring the existence of semantic variability across languages.

Finally, in addition to contributing to an understanding of how children interpret configurations containing scoping elements, the project's results are expected to provide a clearer picture of scope phenomena in adult language and to serve as a basis for new insights into theoretical matters related to scope phenomena in natural language.

8.1 Temporality and temporal adverbials

In preparing for a study on the interpretation of temporal adverbials in child language, Van Geenhoven started to develop a formal dynamic semantic framework for the analysis of temporal expressions and their scope behaviour based on the theory of time in language of Klein. It solves particular semantic problems that arise when dealing with the interaction between quantificational adverbs, *when-*, *before-* and *after-*clauses, focus and aspect.

Van Geenhoven points out that one of the major problems of former semantically oriented models of the development of the temporal system is that these models are silent about the role of (lexical) aspect in the development of time talk: They capture only the temporal relations expressed by tense and regard aspect as nonrelational. Moreover, according to other models, temporal adverbials always specify the *reference time* and, therefore, early temporal adverbials indicate that temporal adverbials can also specify the *event time* or *situation time*.

Van Geenhoven hypothesized that a model based on Klein's relational view of tense and of aspect delivers a formal semantic basis of the 'Aspect before Tense' hypothesis: If both tense and aspect are relational, the fact that they influence each other in the acquisition process falls out naturally. She argues that, so far, it has been ignored that a child must learn, on the one hand, to differentiate the fact that a situation talked about is located in the past/present/future (i.e. identifying the *situation time*) from the fact that the time talked about is located in the past/present/future (i.e. identifying the *topic time*) and, on the other, to relate these two temporal parameters to each other and to the *time of speech*. Following Klein, aspect denotes the relation between topic time and situation time, and tense the relation between topic time and speech time. Assuming that simultaneity (*AT*) is the first relation acquired, it follows that a child will first acquire present tense (=topic time *AT* speech time), either combined with imperfective (=situation time *INCLUDES* topic time) or perfective aspect (=topic time *INCLUDES* situation time). It is furthermore assumed that precedence

(*BEFORE*) and posteriority (*AFTER*) are first added to the range of aspect relations, and that situation time is distinguished first from the topic time/speech time cluster. Hence, the child will first acquire perfect (=topic time *AFTER* situation time) and prospective aspect (= topic time *BEFORE* situation time) before she acquires past (=topic time *BEFORE* speech time) and future tense (=topic time *AFTER* speech time) since it is necessary to uncluster topic time and speech time for the acquisition of past and future tenses. Moreover, as long as topic time is not identified as an independent temporal parameter, it is predicted that the earliest temporal adverbials are descriptions of the situation time, not of topic time. If simultaneity is the first relation acquired, Van Geenhoven's approach predicts that *w/jeɾ*-clauses are acquired before *before*- and *after*-clauses.

Swift continued her Ph.D. research on the acquisition of temporal marking in Inuktitut, an Inuit language spoken in Arctic Quebec. Spontaneous natural speech data from eight Inuktitut-speaking children aged 1;0 - 3;6 were analyzed. The first temporal marking Inuit children produce is with reference to future time events, including prospective aspect marking. The children use temporally unmarked verbs to refer to both ongoing and completed events. This pattern contrasts with that of children learning English, who first produce marked forms for completed and ongoing events, but the Inuit children's speech aligns with the structure of Inuit adult language, which requires overt marking for future time reference, but not for present and some past time reference.

8.2 Finiteness

The acquisition literature focuses on finiteness marking as a strictly morphosyntactic phenomenon. Klein, however, argues that finiteness should be regarded as an abstract operator which serves to mark the assertion. On top of that, it localizes the topic time.

Gretsch began research on the scope properties of finiteness following Klein's framework (see Annual Report 1997). As a first step, the acquisition puzzle of root infinitives was revisited and the data of the Andreas Corpus from CHILDES were (re-)analyzed for their occurring form-function correlations. Key questions were:

- a) When do children acquire a grammatical finiteness marking?
- b) What are the effects of this marking in child language (CL)?

- c) Do the means and the effects of finiteness marking in CL correspond to those used in the adult language (AL)?

Applying the ideas sketched in Klein (1998) on finiteness and those in Gretsche (1998) on the acquisition of focus, the following developmental hypothesis and its implications were put forward:

The use of finite versus infinitival structures in acquisition is NOT optional.

Implication (i): If only finite utterances allow for a structural topic time anchoring, then infinitival utterances should occur only in topic time independent (or preset) usages;

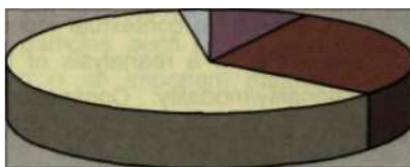
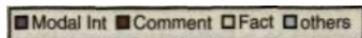
Implication (ii): If the finite component of a sentence exerts scope over the focus part of an utterance then the intervention of other scope-indicating elements (e.g. focus particles) leads to 'scopal conflicts'.

A preliminary evaluation of a sample of 361 intelligible and contextually interpreted utterances from Andreas (2;1) revealed the following distributional properties (counted by token). (See the figures on page 75).

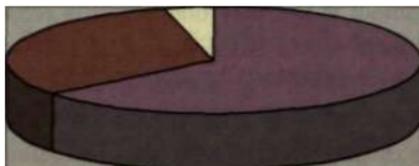
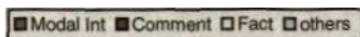
The encountered form-function distribution which is confirmed by other data from the literature on root infinitives shows two separate points. First, the hypothesis is borne out and is only challenged by the structures with comment interpretation. Secondly, every explanation for root infinitives must take all different usages in their differing weighing into account. If root infinitives were used especially by 'learners whose abilities of marking finiteness are not yet complete', as Lasser concludes (see Annual Report 1997), then this meaning differentiation wouldn't be expected when the signaling of finiteness is interpreted as a perfect means of conveying pragmatic information. So the learner's problem does not consist of refining the finiteness system, but refining the form-function correlations to get to the target system.

In Gretsche's account, the mixed use of infinitival and finite structures during that early stage in language acquisition (approx. 2;0 to 3;0) is not seen as a reflex of an insufficiently developed system of syntactic/pragmatic constraints on finiteness but as an elegant and parsimonious way to exploit the grammatical means the child has available at that time to express different topic time interpretations. More

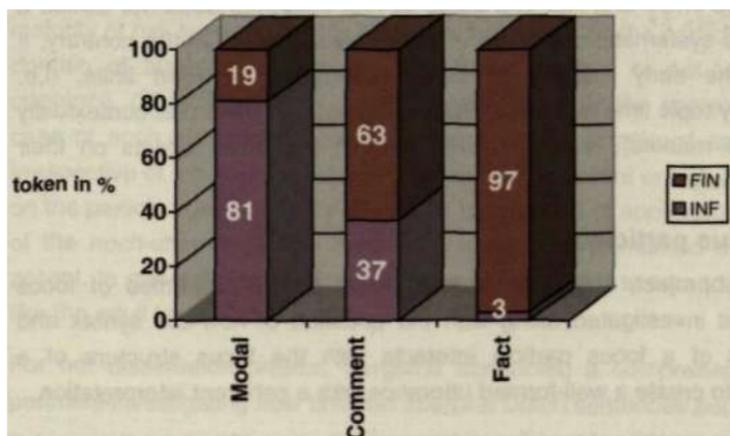
FIN distribution (153 token)



INF distribution (78 token)



FIN-INF Distribution within the functional categories



FIN: finite structures

INF: infinitival structures

Int: interpretation

specifically, the bias for a *modal interpretation* of infinitival utterances (in CL and AL) is explained by the 'avoidance' of setting a topic time parameter *structurally* (in contrast to a finite structure), therefore implying a *contextual* setting. The structural setting at that stage could only encode an extended now-interpretation whereas a contextual induced setting is not restricted in that way, and leads to a reanalysis of the utterance-interpretation involving intentionality/modality. Consequently, infinitival utterances are a perfect precursor for prospective aspect marking.

Concerning the segment of *comment interpretation*, the difference between structural and contextual topic time setting does not matter since the situation time of the speech-accompanying action is related to the topic time of the utterance *by conceptual necessity*. That also explains why this special form-function correlation still exists in the target language.

The *stating of facts* segment is the only one which is restricted to finite structures - both in CL and in AL. Since it aims at a description of the world in its current state ('now'), the encoding does not exceed the grammatical options of the child and allows the contextual topic time setting in the infinitival structures to be functionally restricted to the modal or commenting use.

This differentiated view on root infinitives provides a better understanding of the interplay between finiteness marking and the setting of time relevant parameters in CL and AL. The stage of root infinitives does not exhibit a lack of the systematic command of finiteness marking. On the contrary, it exhibits the early mastery of subtle differences between finite, (i.e. structurally topic time anchored), structures and infinitival (i.e. contextually topic time marked), structures with (nearly) target-like effects on their interpretation.

8.3 Focus particles

In this subproject, children's understanding of the properties of focus particles is investigated along with the question of how the syntax and semantics of a focus particle interacts with the focus structure of a sentence to create a well-formed utterance with a coherent interpretation.

Currently, a number of theories of focus structure and focus particles exist and the grammatical contributions of focus and focus particles to the utterances they appear in are widely debated. In addition, very little is known about how children understand and use focus and focus particles.

Initial investigations are primarily concerned with determining children's understanding of the fundamental concepts underlying mature grammars of focus structure and focus particles.

Heinzel began her dissertation project on the acquisition of the German additive focus particles *auch* ('also') and *noch*, ('another'). In German, focus intonation is an important means of identifying the domain of application of these particles. In general, focus is assumed to be marked by pitch accent. Depending on which element within an utterance is marked by pitch accent, the domain of application of the particle can change.

(1) Max hat auch gestern drei Gläser Bier getrunken.

Max has also yesterday three glasses beer drunk.

'Yesterday Max also drank three glasses of beer.'

In (1), *auch*'s domain of application could be *gestern*, *Gläser*, *Bier* or *getrunken* with a pitch accent on the respective element. If the particle itself carries a pitch accent, *Max* becomes *auch*'s domain of application.

On the basis of the von Stutterheim corpus, a longitudinal study of a girl between age (0;10) and (4;03), Heinzel investigated whether the child marks the domain of application of these two particles and whether intonation is used. The study shows that, even in her early uses the child employs intonation to identify the particle's domain of application. The majority of her *auch*-utterances carry a pitch accent on the particle and the domain of application is to the left of the particle or not within the utterance. (In which case, it can be determined from the context). In the case of *noch*, the particle generally precedes its domain of application, irrespective of whether the particle carries a pitch accent or not. An accent on the particle does not serve to identify the domain of application. In 55% of the *noch*-utterances, the domain of application is marked by a pitch accent. In general, the child's use of the two particles seems to be much like the adult target:

For her dissertation project, Bergsma conducted a comprehension experiment investigating how children interpret Dutch sentences such as (2):

2a) Alleen BERT heeft een peer gewogen.

Only Bert has a pear weighed.

'Only Bert weighed a pear!'

2b) Bert heeft alleen een PEER gewogen.

Bert has only a pear weighed.

'Bert weighed only a pear!'

In adult Dutch, the sentences in (2) receive different interpretations. In (2a), the focus particle *alleen* ('only') takes scope over the subject NP, rendering the interpretation that Bert and no one other than Bert weighed a pear. In (2b), the object NP is in the scope of *alleen* contributing the interpretation that Bert weighed a pear and nothing else. In both sentences, the NP in the scope of *alleen* is marked by intonational prominence. Before it is possible to investigate how children understand the scopal properties of *alleen*, one must know whether children have already acquired the lexical meaning of the particle. Therefore, children's interpretations of sentences with intransitive verbs like (3) were investigated:

3) Alleen ERNIE danste.

'Only Ernie danced.'

Children who did not give adult-like responses on this type of sentence were excluded from the experiment. In the experiment, children were asked to judge whether sentences like (2) matched situations which either related to a subject scope reading or an object scope reading. The results show that Dutch children understand the scopal properties of *alleen* in an almost adult-like way. Almost all of the children correctly assigned a subject scope reading to the (a)-sentences and an object scope reading to the (b)-sentences ((3;05)-(4;04) 63.9%; (4;05)-(5;04) 86.1%; (5;05)-(6;04) 87.1%). Unlike previous experiments (see Annual Report 1997), the results on this experiment show that children perform nearly as well as adults in interpreting sentences with *alleen*.

8.4 NP interpretation

Drozd continued his research on children's understanding of sentences with universal quantifiers and the focus particle *alleen*. In the two preceding Annual Reports, Drozd reported that children as old as 6 - 7 years, who are asked to interpret often find the sentence true only if there are enough boys to ride all of the elephants.

4) Iedere jongen rijdt op een olifant.

'Every boy is riding an elephant'.

This suggests that children incorrectly use their expectations regarding the number of elephant-riders in context to estimate the appropriate size of the domain of quantification (boys) (the Exhaustive Pairing Strategy). Children of the same age also typically adopt one of two non-adultlike strategies for interpreting (5) and (6).

5) Alleen het meisje heeft een ballon.

'Only the girl has a balloon'.

6) Het meisje heeft alleen een ballon.

The girl has only a balloon'.

Most children find both sentences true only if the only the girl from a set of alternatives has a balloon, a conclusion which is incorrect for (6) (Subject-Focus Strategy). Other children interpret both sentences as true only if the girl has only a balloon from a set of alternatives, which is incorrect for (5) (Object-Focus Strategy).

However, children respond correctly on similar picture verification tasks significantly more often when the appropriate domains of quantification/alternatives are first clearly presented in context. Experimental research in 1998 focused on which grammatical model(s) of the children's strategies could best capture the influence of contextual variation on children's interpretations of sentences with universal quantifiers and focus particles.

Drozd hypothesized that children adopt these strategies because they do not resolve existence presuppositions associated with quantificational interpretations like adults. To successfully compute the assertions conveyed by (4) - (6), hearers must appeal to information about shared knowledge, the speaker's intentions, and to decisions regarding which kinds of information are topical/discourse-active or centered in discourse, to determine which domain of quantification/alternatives the speaker wants them to presuppose. As less experienced interlocutors, children may not always be able to coordinate these different kinds of information like adults and choose quantificational/alternative domains which were not intended by a speaker.

As a first step in pursuing this hypothesis, Drozd and Koster (U. of Groningen) investigated whether children have a general difficulty resolving presuppositions by comparing children who adopt the Exhaustive Pairing Strategy with children who adopt the Coreference

Strategy. Dutch children often incorrectly agree that the sentence *Bert wast hem* 'Bert is washing him' matches a picture in which Bert is washing himself, suggesting that the children incorrectly allow the pronoun *hem* to corefer with the c-commanding name *Bert* in the same sentence. Drozd and Koster hypothesized that if presuppositions and anaphoric pronouns are resolved in context using the same mechanism, then the Exhaustive Pairers and the Coreference Strategists should be the same children. The results of a first experiment with 7-year-old Dutch children revealed that children made the Coreference Error significantly more often (21% correct) than the Exhaustive Pairing Error (75% correct). Moreover, correlational analyses revealed that the children who tended to adopt the Exhaustive Pairing Strategy were not the same children who tended to adopt the Coreference strategy. These results suggest that the Exhaustive Pairing and Coreference errors do not have a common source.

In many studies on the semantic interpretation of NPs, a distinction is drawn between weak and strong NPs. From an acquisition perspective, the question arises at what age this semantic distinction becomes active in child language.

Drozd and van der Lely (Birkbeck College, U. of London) investigated if Exhaustive Pairers fully understand that universal quantifiers like *iedere* 'every' are 'essentially-relational' quantifiers (obligatorily presup-positional and distributive). Drozd and van der Lely hypothesized that if Exhaustive Pairers had difficulties resolving the domain presuppositions for *iedere*, they might build 'weak' or cardinal interpretations for *iedere* which neither place the same presuppositional commitments on speakers nor require speakers to build scopal interpretations. An experiment was designed to determine whether Exhaustive Pairers analyze *iedere* and weak cardinal quantifiers like *drie* 'three' the same way. The results revealed that some children did indeed allow *iedere* to have a nonscopal interpretation. However, a correlational analysis revealed that the children who tended to adopt Exhaustive Pairing were not the same children who adopted the nonscopal interpretation. This suggests that children's difficulties with resolving quantificational presuppositions does not lead them to adopt a weak interpretation of a universal quantifier.

Related to the question of at what age the weak/strong distinction becomes active in child language is the question of how a child learns that in some cases a nominal must be interpreted in the scope of an operator. Or, stated in another way, how does a child learn that some nominals can

be within or outside the scope of, for instance, negation whereas other nominals do not have these interpretation alternatives (e.g. a bare plural in Germanic languages and an incorporated noun in Inuktitut are always in the scope of negation)?

In preparing for an answer to these questions, Van Geenhoven and McNally (U. of Pompeu Fabra, Barcelona) elaborated a redefinition of the weak/strong distinction in the interpretation of NPs using the theory of semantic incorporation (Van Geenhoven 1998). They characterize the definitions of *weak* and *strong* as follows. A nominal *a* is *weakly interpreted* in a context *C* iff *a* denotes a property in *C*; a nominal *a* is *strongly interpreted* in a context *C* iff *a* is not weakly interpreted. They argue that weak/strong is better understood as a property of nominal expressions rather than simply as a function of determiner type. This aspect of the novel characterization is especially advantageous for cross-linguistic semantics. Furthermore, they argue that whether a nominal is weak or strong cannot be predicted based on whether it is specific, partitive, or presuppositional, and that the distinction crosscuts the non-quantificational/quantificational distinction. Finally, evidence from child language acquisition suggests that it may be appropriate to regard properties as the primary and default interpretation of nominal expressions in general across languages. Krämer (1998) has shown that Dutch children interpret potentially ambiguous indefinite NPs as nonambiguously property denoting. And the early acquisition of incorporated nouns, as described by Allen for Inuktitut, could be regarded as yet another indication that a property is the first interpretation assigned to a nominal by a child.

Krämer continued her dissertation research on children's interpretation of indefinites. In Dutch, sentence initial indefinite subject NPs are interpreted as so-called free variable indefinites (Van Geenhoven 1998). Preceding discourse plays a role at two levels of their interpretation. First, they are existentially bound at a level higher than the sentence, i.e. their existence is independent of new information that the sentence conveys. This renders a so-called specific interpretation, and insensitivity to operators like negation or *twice*. Second, discourse determines which of a number of potential specific interpretations the indefinite will assume. Krämer hypothesized that children often fail to take discourse into account. This was investigated experimentally, taking the scope properties of the indefinites as a starting point.

When asked to perform *Een knikker mag twee keer rollen* 'A marble may roll twice', Dutch adults take one marble and make it roll twice. Children between age 4 and 8 often take two marbles. For these children, the indefinites are not existentially bound beyond the sentence level: If they were, they would not be sensitive to the operator *twice*.

When asked to judge *Een meisje is niet aan net dansen* 'A girl is not dancing', adults accept the sentence in a situation in which one of two girls is not dancing, while another girl (in addition to a boy) *is*. Many children reject the sentence, because of the one dancing girl. Further analysis of the children's responses and a follow-up experiment show that the children fail to assign the appropriate concealed partitive interpretation to the indefinites. Instead, they have a so-called straight reference interpretation, which allows them to disregard linguistic discourse. This interpretation makes the children focus on just one of the girls, often the one that will result in a 'false' judgment.

9 ARGUMENT STRUCTURE

This project explores universal and language-specific aspects of argument structure and its acquisition. Research focuses on the semantics of predicates and the morphosyntactic behavior of arguments, and is pursued through investigations of individual languages, comparisons across languages, and spontaneous speech analysis and experimental work with children. Work in 1998 addressed four often interrelated topics:

- 1) The syntactic-semantic interface. How uniform are the links between syntactic functions and semantic roles across languages? What are the relationships among argument structure, event structure, and morphosyntax?
- 2) Identifying arguments. What criteria are there for identifying arguments? For distinguishing semantic arguments from syntactic arguments? For determining what functions as an argument under different constructions?
- 3) Cross-linguistic perspectives on predicate classes. Do groups of verbs form coherent sets on the basis of their argument structures? If so, are these sets semantically motivated and cross-linguistically consistent? How do children acquire aspects of verb meaning that are critical to a verb's predicate class membership?
- 4) Argument realization: What determines whether arguments are overtly realized, and, if so, what form they take? How do children master the

semantic, syntactic, and pragmatic conditions under which arguments are expressed or omitted?

An additional important activity of project members in 1998 was the organization of a workshop entitled Cross-linguistic Perspectives on Argument Structure: Implications for Learnability. This workshop, held in June, presented project research carried out over the last several years and solicited feedback and discussion from invited commentators.

9.1 The syntactic - semantic interface

Semantic distinctions made in transitive clauses are often collapsed in intransitive clauses: in particular, accusative languages treat all intransitive subjects like the agents of transitive verbs, while ergative languages treat them like the patients of transitive verbs. Split-S languages, however, treat agents and patients in the same way regardless of whether they occur in transitive or intransitive clauses (resulting in a semantic 'split' in the coding of subjects of intransitives depending on the meaning of the verb). Bowden explored applicative constructions in Taba, a split-S Austronesian language, to determine whether there is a parallel semantic transparency in the relationship between its ditransitive and monotransitive clauses. It has been claimed that, just as distinctions made in transitive clauses (i.e. subject and direct object) are typically collapsed in intransitive clauses, distinctions made in ditransitive clauses are typically collapsed in monotransitive clauses, with the monotransitive direct object treated like the ditransitive direct object in some languages and the ditransitive indirect object in others (Dryer, 1986). Bowden showed that argument realization remains relatively semantically transparent in *all* clause types in Taba, including ditransitives and others with applicative licensed arguments. That is, a distinction in object type is maintained and predictable on purely semantic grounds.

Bohnenmeyer completed his Ph.D. dissertation *Time Relations in Discourse. Evidence from a comparative approach to Yukatek Maya'*. This study was not focused on argument structure per se, but examined a broader problem of form-to-meaning association, the resolution of which has important consequences for the understanding of predicate argument structure in Yukatek Mayan. The research shows that, with certain marginal exceptions, event order is not part of truth-conditional semantic representations in Yukatek. In particular, there are no tenses and no temporal connectives equivalent to English *after* and *before*. Time

reference in Yukatek emerges as inference-driven, based on boundary operators such as aspectuals and phasals, to an extent hitherto unattested in typology. The results of a study involving a referential communication task with a non-verbal stimulus suggest that discourse representations of event order are pragmatically equivalent across speakers of Yukatek and German, even though event order regularly forms a truth-conditional part in the utterances of the German speakers, but not in those of the Yukatek speakers. No difference in cognitive representations of event order across speakers of the two languages was attested. To account for these results, a theory of inferences from aspectual information to event order in terms of Generalized Conversational Implicatures is proposed.

Bohnenmeyer's study also delivers new insights into the cross-linguistic variability of the interaction of argument-structure and event-structure features at the lexicon-morphosyntax interface. Unlike in Indo-European languages, lexical event structure does not contribute to temporal coherence in discourse. The temporal interpretation of clauses in Yukatek relies entirely on overt morphological categories of aspect-mood marking. Aspect-mood marking is obligatory, and every verb stem can appear in every aspectual and modal category. Aligning with this, Yukatek morphosyntax proves insensitive to telicity. There is no telicity distinction in duration adverbials (of the type *in/for two hours*) or phasal operators (such as English *finish* versus *stop*), and the complex system of morphological predicate classes is motivated entirely in terms of argument structure semantics, not in terms of event structure semantics.

9.2 Identifying arguments

As part of his dissertation research, Zavala investigated the argument structure of a subset of formally intransitive verbs such as *jo:m* 'sweat' and *jotan* 'be angry' in Olutec (Mixe-Zoquean). Zavala showed that, although these verbs are syntactically monovalent, their morphosyntactic behavior indicates that they are semantically bivalent: one participant is a conflated theme and the other is an experiencer or location which functions as the only overt clausal argument. Three pieces of evidence support this claim. First, 'sweat' and 'be angry' follow the inverse pattern, which up to now has been cross-linguistically attested only with bivalent verbs (see Annual Report 1996). The presence of inverse morphology indicates that the overt experiencer outranks another argument in saliency, and this entails that there IS a second (unexpressed) argument. Second, 'sweat' and 'be angry' pattern together with two other types of intransitive verbs which are

also semantically bivalent, both of which have an experiencer expressed as a clausal argument and a theme associated with the verb. In the first type, the theme is incorporated into the verb (e.g. *kotzpa+jo:m* 'sticky stuff+sweat'), while in the second the verb consists of a denominalized theme (e.g. *ka:na+ax* 'salt + denominalizer: HAVE'). Like clauses with 'sweat' and 'be angry', clauses with one of these two types of verbs follow the inverse pattern, since the conflated theme is outranked by the experiencer. A third piece of evidence comes from the phenomenon known as 'parallelism': the production of two utterances expressing the same propositional information. Olutec speakers paraphrase a clause with only one syntactic argument ('I am sweating') with a clause with two syntactic arguments ('sweat comes to me', 'sweat is on me'). These facts confirm that the direct/inverse alternation is sensitive to the thematic structure of the verb independently of the syntactic status of its arguments.

In her Ph.D. research, Margetts (formerly Keusen) has worked on the expression of valence and transitivity in Saliba, an Oceanic language of Papua New Guinea. Like many other Oceanic languages, Saliba has a type of construction which shows both transitive and intransitive features. In this construction, a morphologically intransitive verb occurs with a lexical object. This object is clearly not incorporated into the verb in Saliba, but rather is morphosyntactically independent. To characterize these verbs more closely and solve additional transitivity problems, Margetts defines valence and transitivity independently on three structural levels: the verb root, the inflected verb and the clause. Root valence is defined by a root's ability to occur as an underived intransitive and/or transitive verb stem. Word-level transitivity is defined morphologically by the number of arguments marked on the inflected verb. Clause-level transitivity is defined by the overall number of arguments expressed in the clause. The relation between the three structural levels can be one of accord or discord, i.e. the transitivity status (or valence) of the lower-level unit may or may not match that of the higher-level unit. For example, a (morphologically) intransitive verb may occur as the head of an intransitive clause (accord in transitivity status) or as the head of a transitive clause (discord in transitivity status). Under this treatment of transitivity, a construction as a whole may have both intransitive and transitive properties, but on a given structural level it will be either intransitive or transitive.

9.3 Cross-linguistic perspectives on predicate classes

Schultze-Berndt completed her Ph.D thesis, entitled 'Simple and complex verbs in Jaminjung: A study of event classification in an Australian language'. In Jaminjung inflecting verbs constitute a closed class with fewer than 35 members. These may occur as verbal predicates on their own, or form complex predicates with members of an open class of lexemes termed 'coverbs'. Coverbs form a lexical category distinct from both verbs and nominals and may not function as predicates on their own in finite clauses. The most interesting consequence of this structure of the verbal lexicon is that it results in an overt system of event classification.

Since one of the closed-class verbs is obligatory in every finite clause, the set taken as a whole sorts all event expressions into a relatively small number of categories. The majority of complex verbs are semantically compositional. This was shown by (i) examining the semantics of each verb in detail, (ii) establishing semantically circumscribed formal classes of coverbs according to the way they could form complex verbs, and (iii) investigating the argument structure of the resulting complex verbs. The choice of a closed-class verb is based on its meaning, which may be of a very general and/or polysemous nature, and is often reminiscent of 'light' or 'basic' verbs found in other languages

Essegbey continued his investigation into the semantics of inherent complement verbs (ICVs, see Annual Report 1996) in Ewe (Kwa, Niger Congo) by turning his attention to their semantics. He demonstrated that the verbs are not only meaningful but that their meanings are invariant across most contexts. However, the meanings are underdetermined, so they cannot be accounted for within an analysis that adopts a concatenative view of compositionality. Following Wilkins and Hill (1995), Essegbey adopts two levels of semantics for the verbs, with the invariant meanings established at one level. At the other level, other factors contribute to the interpretation of the verbs. Among them are the semantics of the verbs' arguments and the argument structure construction (cf. Goldberg, 1995), in which they occur. An example is the ICV *da*, which Essegbey characterizes as:

An entity (X) through the use of a part of the body causes an entity (Y) to move away.

The default interpretation given this verb is 'throw'. When its complement refers to a hook, then the default interpretation is 'to cast a line'. The three-

place construction in Ewe expresses 'caused transfer' (Annual Report 1997). When *da* occurs in it, the construction contributes the third argument, which is constructionally interpreted as the end-point, hence the goal of the throwing event. The default interpretation then becomes 'strike'. The allative prepositional phrase expresses an end-point to which something moves to be located. When *da* occurs with this phrase, the default interpretation is 'to put'. The underdetermined semantic characterization provided above thus accounts for apparently diverse glosses such as 'throw', 'cast a line', 'strike', and 'put', none of which represents the meaning of *da*. They all represent default interpretations which can be defeated.

Ameka investigated the argument structure and semantic shifts of elements that can be translated as 'DIE' in Ewe and cross-linguistically. It is generally assumed that the intransitive change of state and achievement predicate DIE is universally unaccusative. There is evidence to suggest that this may not be entirely true: in many languages, including English and Ewe, the DIE predicate can also occur with cognate objects (e.g. *She died a horrible death*). It has therefore been argued for English, for example, that DIE is unergative (Macfarland 1995). The expectation is that DIE, as an intransitive verb, should fit into one or the other class. However, Essegbey has demonstrated that the unaccusative/unergative distinction is not applicable to Ewe (see Annual Report 1996). Furthermore, in Ewe, the verb *kit* 'die' occurs not only in the intransitive construction but also in two types of two-place constructions: the Theme-Locative and the Effector-Theme constructions. Corresponding to this distribution are two features: increase in transitivity and semantic shifts. In the one-place construction the verb has DIE semantics, that is, 'entity X loses a salient property (Y) of a true X'. In the Theme-Locative construction the semantics shifts to INTENSITY, that is, 'person X has more of property Y than one would expect'. For example, *Ekü nyägä*, literally, 'S/he died an old person', means 'S/he is a very old person'. In the highly transitive Effector-Theme construction, the meaning shifts further to a DESIDERATIVE reading. Thus, an interpretation of the sentence below is that the Effector does not WANT to pay heed to the matter.

E-kü tö oje nya lä me
 3SG-die ear ALL matter DEF INSIDE

lit: 'S/he died ear to the matter'

'S/he turned a deaf ear to the matter'

Moreover, the meaning shifts observed in Ewe occur in typologically and genetically unrelated languages. In Oluta (Mixean) the verb *ʔo:k* 'die' has grammaticalized as a satellite modifying a verb and meaning 'do V too much' (INTENSITY), and as an auxiliary with a verb infinitive complement expressing 'want to V (DESIDERATIVE)'. In English, the verb *die* has an INTENSITY reading in *I am dying of thirst* and a DESIDERATIVE reading in *I am dying to see you*. These shifts apply to non-verb DIE elements as well. For instance, the adjective *dead* shifts from 'die' to INTENSITY in phrases like *dead easy*, *dead calm*. Similar shifts occur in Dutch and Arrernte. This shows that the behavior is not dependent on syntactic category, but rather on the semantics of DIE elements. These findings throw some light on the nature of argument structure as it relates to grammaticalization, semantic change, and the alignment of syntax and semantics.

In English, basic perception verbs manifest three event-types: 'controlled activity', 'non-controlled experience' and 'source-based state'. These three distinctions are given distinct lexical representation for the sensory modality of hearing (e.g. *I listened to the radio*, *I heard the radio*, *The radio sounded faint*) but are, for instance, lexically conflated for the sensory modality of smell (*The chef smelled the soup*, *I could smell garlic*, *The soup smelled of garlic*). As part of a larger study on polysemy and semantic change in the perception verb lexicon, Wilkins and Evans (U. of Melbourne) have examined how these event-types are expressed in a broad range of Australian languages. The only sensory domain for which a large number of Australian languages has more than one lexical verb is 'smell'. However, many Australian languages share similar syntactic strategies for the expression of an event type. For instance, they commonly use constructions in which there is a secondary predicate on the object for the expression of 'source-based state' (as suggested by *I heard the radio faint* [=the radio sounded faint to me]).

In her dissertation project, which was almost completed by the end of 1998, Wittek investigated the acquisition of the meaning of morphologically simple and complex change-of-state verbs in German. The dissertation explores two major questions. First, how do children interpret change-of-state verbs? In a series of comprehension experiments, Wittek has demonstrated that although children often show that they are aware of the particular endstate associated with a verb like *wake* or *kill* (being awake/dead), they accept uses of the verb for situations in which the

endstate is not realized. Their interpretations look in many respects like adult interpretations of verbs like *wash* and *sweep*, which 'pragmatically favor', but do not entail, a certain endstate such as 'clean'. Second, Wittek asked how children learn to distinguish between pragmatically favored versus semantically entailed endstates. She tested the hypothesis that children can identify entailed endstates by hearing the verb modified by an adverbial that 'picks out' the endstate. In being picked out, the endstate is highlighted and made informationally more salient, which might lead to the inference that this component is critical for the verb's meaning. One such adverb is *again*, or German *wieder*, in its 'restitutive' (as opposed to repetitive) reading (as in *The prince woke Sleeping Beauty again, where again* applies to Sleeping Beauty's state of being 'awake', not to any repetition of the prince's action). A comprehension study with novel verbs applied to novel events confirms this hypothesis: children were significantly more likely to interpret the meaning of new verbs as entailing the realization of an endstate if they heard them modified by restitutive *wieder* 'again' than if they heard them in the same sentence without the *wieder*.

9.4 Argument realization

Senghas has been following the emergence of grammatical devices in Nicaraguan Sign Language, focusing on the means of expressing semantic roles. Nicaraguan Sign Language presents a particularly interesting case, not only because it uses the manual-visual modality (as opposed to the oral-auditory modality of spoken languages) but, more importantly, because it is a very young language (only 18 years old) undergoing dramatic changes as a generation of Deaf children is learning and contributing to it.

Work in collaboration with Coppola, Newport, and Supalla (U. of Rochester) has revealed developments in Nicaraguan Sign Language with respect to how lexical arguments are realized. Verb phrases appear to allow only one lexical animate argument per verb stem. Thus, events involving two animate participants (e.g. a woman pushing a man) require two verbs if both participants are to be represented lexically, as in (1) and (2). The two verbs are complementary, in that they express two roles or perspectives that together make up a single event.

1) WOMAN PUSH MAN FALL.

'A woman pushes a man.'

2) WOMAN CUP GIVE MAN RECEIVE.

'A woman gives a man a cup.'

This restriction of one animate noun per verb is true for all adult (first cohort) and adolescent (second cohort) signers of the language. In addition, first-cohort signers consistently produce these elements in the NVNV order seen in (1) and (2) above, with each verb preceded by its animate argument. However, second-cohort signers (but not first-cohort signers) also produce utterances in which the arguments appear in other positions in the sentence, as in (3) and (4). The various orders permitted appear to obscure the semantic roles that were originally communicated by strict word order.

3) MAN WOMAN PUSH FALL.

'A man pushes a woman.' OR 'A woman pushes a man.'

4) WOMAN MAN PUSH FALL

'A man pushes a woman.' OR 'A woman pushes a man.'

This development raises the question of how semantic roles are now being indicated by the second cohort. The answer seems to lie in the use of spatial affixes, a typical feature of signed languages. The physical direction in which a verb is produced can serve as an affix linking that verb to previous referents in the discourse. In both their production and comprehension of signed sentences, second-cohort signers (but not first-cohort signers) treat the side to which a sign is produced as a meaningful feature. Furthermore, only these younger signers share a common sign-space for physical-space mapping, making the unambiguous assignment and interpretation of semantic roles possible. The second cohort appears to have reanalyzed particular spatial devices to form a stricter, narrower system in which certain referents (now linked with particular verbs) are specified more precisely. However, this change means that in cases where the context provides minimal cues, first-cohort signers actually misinterpret the assignment of semantic roles in the sentences produced by second-cohort signers. Nevertheless, among signers of the second cohort, this morphological development has cleared the way for word order changes (or perhaps variability) without sacrificing the successful communication of semantic roles.

Allen continued her investigation into the relationship between argument form (ellipsed versus overt) and pragmatic prominence in Inuktitut (see Annual Report 1997). Inuktitut allows massive ellipsis of NP arguments

(about 82% of subjects and objects in the sample of child speech studied). Allen's previous work showed that argument form in Inuktitut is not random; it is determined by structural constraints of Preferred Argument Structure (cf. DuBois 1987), and by discourse constraints of pragmatic prominence (cf. Clancy 1997). This year, Allen examined the relative contributions towards argument form of eight different features of pragmatic prominence in the speech of four Inuktitut-speaking children aged 2;0 - 3;6. Analysis using logistic regression showed that a model containing all eight features of pragmatic prominence is significantly more accurate at predicting which arguments will be overtly represented than a model containing none of these features.

Of the eight features studied, five have a significant effect on the form of the argument: third person, contrast, newness, absence, and differentiation in context. Results are similar if only third person arguments are considered in the analysis. In addition, the odds of an argument being overt are four times as large if the argument has at least one feature of pragmatic prominence, and twice as large if only third person arguments are considered. Although models using the pragmatic prominence features were good at predicting which arguments would be elided (over 90% were predicted accurately), they were much worse at predicting which arguments would be overt (around 50%). This is partly because so many arguments are elided that the occurrence of ellipsis is relatively easier to predict, and it undoubtedly also reflects the additive and combinatory effects of the different features taken together. This issue will be the focus of future research.

P. Brown continued her examination of Tzeltal (Mayan) children's acquisition of argument structure (see Annual Report 1997). She is exploring the hypothesis that semantic specificity in Tzeltal verbs has an influence on children's realization of nominal arguments, and thereby on their acquisition of argument structure, especially transitivity. A typological characteristic of Mayan languages is that the meaning of many basic-level transitive and positional verb roots is highly specific, incorporating features of the co-occurring arguments. There are, for example, many different verbs for eating, carrying, breaking, setting something down, and tipping something over, with the choice depending on the shape, substance, position, or orientation of the objects corresponding to the internal or external arguments. These verbs are basic-level in that they are monomorphemic, in frequent everyday use, and not specialized to a particular

register. They are also prominent among Tzeltal children's first transitive verbs, and are among the first verbs to be combined with other morphemes by children at the one- to two- word stage. This early focus on semantically specific verbs is in striking contrast to the predominance of semantically general ('light') verbs in the initial productive vocabularies and first combinations of children learning Indo-European languages and Hebrew.

The difference between children learning Tzeltal and other languages cannot be explained away on grounds that Tzeltal learners actually assign general ('light') meanings to verbs that for adults are semantically specific: children do not overgeneralize the verbs, as they would if this hypothesis were correct. Nor can it be explained solely by reference to differences in the input frequency of semantically specific versus 'light' verbs in the different languages: as in English, the most frequent transitive verbs in Tzeltal input speech are general verbs like *k'an* 'want', *aK* 'give', *ich?* 'get', *pas* 'do'. It seems plausible that the earliness of specific verbs for Tzeltal children is related to the fact that Mayan verb semantics is relatively 'nouny': the referents of specific verbs are more concrete, they are semantically informationally richer, and the range of contexts they are appropriate in is more easily delimited. Redundancy may also play a role; information about the O argument's referent (typically Patient) is carried in both the verb and the Object NP.

One obvious potential consequence of such a semantic structure might be that it affects the degree to which nominal arguments are overtly realized. (Tzeltal allows free ellipsis of arguments; these are, however, obligatorily cross-referenced on the verb.) Since the search space for arguments is radically reduced with specific verbs, overt noun phrase arguments may be less often required in natural speech. P. Brown therefore tested the hypothesis that, for Tzeltal adults and children alike, the O argument is realized lexically less often when the verb is specific (like *ld* 'eat-squishy-things') than when the verb is general (like *ictf* 'get'). She examined argument realization in the natural speech data of three children (about 2000 utterances from each) between the ages of 3;4 - 3;9, as well as in a sample of adult input. The verbs were classified into one of three semantic categories: general, specific, and 'intermediate' in specificity. P. Brown found that Tzeltal adults are indeed less likely to represent the O argument of a transitive verb lexically (i.e. there is a higher rate of null O) if the verb is specific than if it is general; this is also true for Tzeltal children, although

the discrepancy in argument realization for verbs of the two kinds is lower. This finding suggests that Tzeltal children follow a different verb-learning strategy from English children. P. Brown speculates that for a language with obligatory NPs (like English), a 'light' verb strategy is sensible, whereas for a language with massive NP ellipsis (like Tzeltal), a 'heavy' verb strategy is better. With respect to Preferred Argument Structure constraints (see Annual Report 1997), the Tzeltal data suggest that in addition to pragmatic constraints, we need to consider-at least for some languages-the presence of semantic constraints: namely the pre-emption of explicit argument realization by specificity in the verb.

10 THE STRUCTURE OF LEARNER VARIETIES

This project differs from other Institute projects in that only a small fraction of the actual work is done at the Institute itself. Its role is rather to coordinate the joint research of a group of European research centers, in particular the universities of Aix-en-Provence, Amsterdam, Berlin (Freie U. and Humboldt U.), Heidelberg, Paris III, Paris VIM and Paris X, Pavia, and Tilburg. In a number of ways, this European network continues work started in the European Science Foundation's project 'Second language acquisition by adult immigrants'. The aim of that first project was to describe and explain learners' language development right from the beginning, to relatively advanced stages of acquisition, through a detailed examination of their language use. The current project theoretically and empirically elaborates on the data and findings of this earlier research.

The process of second language acquisition is not to be characterized in terms of errors and deviations, but in terms of the two-fold systematicity which it exhibits: the inherent systematicity of a learner variety at a given time, and the way in which such a learner variety evolves into another one. If we want to understand the acquisition process, we must try to uncover this two-fold systematicity, rather than look at how and why a learner misses the target.

In the first phase of the current project, priority was given to the first of these two types of systematicity. Research focused on the inherent organization of various learner varieties, notably the Basic Variety (BV). This is a particular learner variety which all adult learners who acquire a language by everyday interaction appear to develop, independent of source language and target language. The BV is based on a limited set of

organizational principles of different types. These principles interact, and it is this which determines the actual organization of a given learner variety. The BV works structurally so long as the semantic, pragmatic, and phrasal constraints that organize it can be reconciled. Cases of competition between these sets of constraints provide a powerful motive for learners to acquire more specific structuring devices of their target language (TL). It thus appears that the need to interrelate the entities and events referred to in the construction of (more) cohesive discourse is the motor driving the acquisition of the TL's morphosyntax.

Recent work in the current project has focused on two structural properties of the Basic Variety and, to a lesser extent, other, more advanced learner varieties:

- (1) Referential movement. How does the learner express and integrate information from different semantic domains (time, space, person, events) when producing a coherent text?
- (2) Scope phenomena. How does the speaker reconcile the logical structure of his utterances with the syntactic specifics of the language being learned, i.e. negation, frequency adverbials, scope particles, quantified expressions?

In the following report, we focus on these two sections. The work of Hendriks and Starren was done at the Institute itself. We also include three typical examples of work done at other centers (Ahrenholz, Dimroth, Silberstein).

Hendriks focused on the acquisition of the topic marker in French: the dislocation. Data used are narratives on the basis of picture sequences produced by native speakers of French at 4, 7, 10 years, and adults, and semi-guided adult Chinese learners of French. The monolingual data stem from a database collected by Hickmann (see Annual Report 1987).

Dislocation is a particularly interesting device to look at. If the assumption that discourse organization follows universal pragmatic principles is correct, adult Chinese, speaking a topic-prominent source language, should have no problems discovering its *functions* in French. Similarly, if these principles have to be acquired in L1, French children should have trouble discovering its functions. A separate question concerns the acquisition of its linguistic *form*.

In Chinese, topics are marked by the first position in the sentence. In French, the topic is marked by dislocations, which consist of a full noun and a clitic. Topics are necessarily definite, or given information in discourse. To promote *new information* to a topic position, both languages use existential constructions.

The function of topics is to relate material in a sentence to material in previous or following sentences. This involves introducing subtopics, reintroducing old topics, and expressing contrastive information. Note that in French the *reintroduction of topics* is also possible with cleft constructions as in (1).

(1) Et il y a *la maman qui* revient avec un ver de terre. (CLEFT)

'And there is the mother that comes back with an earthworm.'

Et *la maman eile* revient avec un ver de terre. (DISLOCATION)

'And the mother she comes back with an earthworm.'

Hypotheses predict that (a) if a speaker knows what topics are and how to mark them, left dislocations in French should never occur with new information. Children might have to acquire this, whereas adults should know this; (b) since the topic function in Chinese does not translate into *one form only* in French, Chinese adults might have problems finding the right form in French.

Hickmann and Roland have shown (Annual Report 1987) that children only gradually learn to use dislocations exclusively for given information. Their data shows furthermore that children at early stages have not yet mastered the given-new distinction in general, and that it is not merely a problem with the dislocation. Adult L2 data is analyzed and the results are compared with that from children.

The L2 data show that Chinese learners hardly ever use dislocations to introduce new information (1 occurrence). In contrast to the children, their dislocations occur as often in coreferential as in non-coreferential contexts. Overlapping functions are the reintroduction of topics and making new information old, but adults use dislocations furthermore for contrastive functions, as in (2):

(2) Le cheval et la vache se regardaient pendant un instant, et le cheval il decida de sauter par-dessus la barriere, et la vache eile le regardait.

The horse and the cow looked at each other for a while, and the horse he decided to jump over the fence, and the cow she watched him.'

As far as *form* is concerned, data shows that children have no problem acquiring it, whereas adult Chinese learners have difficulties keeping dislocations and cleft constructions apart. They frequently produce constructions such as (3), which may be interpreted either as an incomplete cleft (*// y a* is missing), or as a dislocation with the wrong pronoun (relative instead of personal):

(3) Et puis de gros chien qui a tire de queue de le chat.

'And then the big dog who pulled the tail of the cat.'

In sum, we find two main differences between child L1 and adult L2 learners of French: Adults *know* that dislocations cannot be used for referent introductions, children have to *learn* this. Children use dislocations mainly in non-coreferential contexts with one function only. Adults use dislocations in coreferential and non-coreferential contexts, with a multitude of functions that correspond to the functions of topics in their source language. Finally, the unclear form-function relation in French seriously disturbs the L2 learners' acquisition of the form.

Starren continued her work on the structural embedding of early tense and aspect markings in second language acquisition by learners of Dutch and French she provides a unified account for the structural embedding of both lexical temporal adverbials and the first proto-verbal markers of tense and aspect in L2 learner varieties. Starren found clear evidence that the basic position of temporal adverbials in early learner varieties functions as a mould for building up the target morphosyntactic tense and aspect system in later stages of second language acquisition. A comparison of Moroccan Arabic learners of French and Moroccan Arabic and Turkish learners of Dutch showed a similar acquisitional pattern in building up verbal morphology. However, the learners of French go through a much longer stage of analyzing the synthetic cluster of prefixes and suffixes around the French lexical verb. It is only after this stage of 'unpackaging' a complex finite form (+ subject, + indirect object) like *// m'a da*, 'he told me', (which is considered in the earlier stages as one unanalyzed complex lexical verb *ilmadif*) that Moroccan learners of French can start to build up the target French morphosyntactic system. Analyses of later stages of acquisition showed that, just like learners of Dutch, Moroccan learners of French use

free auxiliary forms expressing tense and aspect to fill in the utterance structure shaped earlier by the embedding of temporal adverbials.

Ahrenholz (F.U. Berlin) investigated personal reference, zero-anaphora, and clause combining. His research concerns the question of what use non-native speakers of German with a pro-drop source language make of the possibilities in German of leaving the subject implicit and marking it only morphologically. Although German is normally considered as a non pro-drop language, it can be shown that, in narratives and instructions by native speakers, there can be frequent and extended use of dropping explicit subject reference to create text cohesion and produce episodes and phases of activities. As for acquisition, there is a distinct development from an early stage in which the lexical means are not yet acquired and personal reference therefore remains implicit, towards an explicit use with the tendency of overmarking. While native speakers apply principles of text cohesion, the speech production of the non native speakers is, for a long time, bound to single utterances. Only in a more advanced stage do the learners acquire the means of using clause combining and native-like maintained implicit reference to the subject.

Dimroth (F.U. Berlin) investigated the role of scope particles and information structure in the process of second language acquisition. In the target language (German), scope particles show great syntactic variability. As in many other languages, positions are available that unambiguously identify the particle's domain of application (i.e. in the prototypical case, the focus of the utterance). Second language learners tend to acquire scope particles in these positions first. But as acquisition goes on, learners seem to give up these secure positions for more ambiguous ones-and the question is, why. An answer is found through a closer look at the information structure (topic-focus structure and referential movement) of the type of utterances involved: learners do not just give up an unambiguous position of the particle adjacent to the domain of application for an ambiguous one, but they acquire the additional possibility of differentiating between particles affecting the information focus of an utterance and particles affecting contrastive parts of an utterance's topic. In the latter case, the information focus of the utterance might be the scope particle itself.

Silberstein (H.U. Berlin) conducted a study on negation as a trigger for syntactic development. Her study deals with the acquisition of negation by an adult Italian learner of English. With the insertion of negation, scope is

induced into a given sentence that is already structured according to pragmatic principles (topic/focus). In trying to insert negation, conflicts between discourse pragmatic principles (*focus last*) and the scope-rule developed in the early phases of acquisition (*scope-right-rule*) arise. It is shown that this conflict enhances further development towards syntactic structures of the target language

11 OTHER RESEARCH

11.1 Language Acquisition

11.1.1 Cues to word meaning

E. Clark conducted studies on the kinds of information which are offered to children about word meanings in the course of conversations. She was additionally interested to see if there was evidence that children take up such information and immediately make use of it. Her initial focus was on offers of information about the kinds of semantic relations that hold between two words, at least one of which is already known to the child. Analyses of adult-child conversational exchanges suggest that parents offer young children a range of different semantic relations while experimental studies of word learning provide strong evidence that such information is indeed taken in and made use in the course of word-learning.

11.1.2 Specific Language Impairment

Allen, in collaboration with Crago (McGill U.), investigated the use of optional infinitives in typically-developing (TD) and specifically language impaired (SLI) children learning Inuktitut as a first language. Previous research has shown that TD children learning many languages go through a stage of optionally using either infinitive or correctly inflected verb forms at around the age of 2;0 (MLU approximately 2.0). Children with SLI learning English and German go through an extended optional infinitive stage lasting until age 7 or later. However, TD children learning null subject languages (e.g. Italian, Hebrew) do not typically go through an optional infinitive (OI) stage. The question remains whether SLI children learning a null subject language will go through an extended OI stage;

research to date has shown mixed results. Since Inuktitut is a null subject language, it provides an interesting avenue for investigation of this question.

Analysis of 400 verbal utterances from 4 TD Inuktitut-speaking children aged 2;0-2;1 (MLU approximately 2.0) showed that no OI stage is present in TD child speech in this language: over 90% of verbal inflections were correctly produced for those verb roots requiring an inflection. However, analysis of some 40 verbal utterances from one SLI Inuktitut-speaking child aged 5;4 showed that only 53% of her verbal utterances were correctly inflected; 26% were uninflected and 21% were inflected with a filler form that is not used in typical child or adult Inuktitut.

Allen and Crago conclude that this SLI child is in an OI stage. These results support previous research showing that no OI stage occurs in TD children learning null subject languages. However, they do not support the idea that the OI stage in children with SLI is an extension of a normal stage of language acquisition. Since the SLI child in our study is learning a language for which an OI stage in acquisition is not usual, her language shows deviation from typical patterns of development rather than delay.

11.2 The Role of Counting in the Grammar

It has often been claimed that the grammar can count to one and no higher. However, with the notable exceptions of prosodic circumscription in phonology and subadjacency in syntax, the number 1 has not often been exploited in linguistic analysis. Walsh Dickey, in collaboration with Gnanadesikan (Educational Testing Service, USA) drew together phenomena from all parts of the phonological realm to demonstrate that the distinction between zero, one, and many is pervasively active, and show that reference to the number 2 is not necessary.

Walsh Dickey and Gnanadesikan brought the 'one versus many' distinction to diverse domains of phonology in order to (1) account for facts which have previously eluded analysis (Tzelta counting allomorphy); (2) bring together disparate-seeming phenomena under one system (allomorphy, dissimilation, stress, faithfulness, attraction, affix placement, reduplication, extrametricality); and (3) constrain currently available mechanisms in Optimality Theory, such as constraint conjunction, allowing them to capture the facts but not predict unattested patterns. The following primary cases were analyzed in support of phonological reference to the

number 1: Tzeltal counting allomorphy, Axininca stress placement, and Ganda dissimilation.

In the Tzeltal perfective morpheme, vowel quality depends on the syllable count of the stem (one syllable versus many). The current research ruled out stress, segmental, and semantic accounts and instead showed that the constraints governing the surface forms of the morpheme must be ranked below a constraint stating that one allomorph always be misaligned to the edge by exactly one syllable.

Main stress in Axininca falls preferentially on the ultimate foot, but will occur on the penultimate foot if its head is more prominent. Stress never occurs any further from the end of the word, no matter how prominent the foot head. The relevant constraints require stress to be (1) edgemoat and (2) no more than one foot from the edge. Stress systems occur where one, both, or neither of these constraints is dominated (e.g. Klamath versus Nahuatl).

Only one prenasalized stop is tolerated per word in Ganda, further instances dissimilate. This is analyzed with the set of constraints: *Prenasal*^{oo} (which rules out more than one prenasalized stop) and *Prenasal* (which rules out any). These constraints, like constraint conjunction, force dissimilation when faithfulness constraints are ranked between them. The proposed constraints, however, exclude the unattested possibility of a language contrasting 2 occurrences of some feature with 3 occurrences, etc.

Analysis of previously recalcitrant data, as well as traditionally analyzed data, show evidence for reference to the number one in the formulation of constraints. This research demonstrates that counting to 1 and only 1 is not just a meta-constraint on the grammar, but is an integral and active part of the phonology.

11.3 Comprehension in discourse

11.3.1 Semantic and syntactic integration processes during comprehension

Vonk, in collaboration with Hoeks, Mak, and Schriefers (U. of Nijmegen), continued research on the role of semantic/pragmatic information in the processing of structurally ambiguous sentences. Two structural ambiguities were investigated: conjoint NPs versus sentence conjunction, and subject relative clauses versus object relative clauses.

11.3.2 Conjoint NPs versus sentence conjunction

According to Construal Theory, readers initially assign an NP-coordination when they read a sentence like (1), and only later, when encountering the second verb, parse the sentence as an S-coordination.

- (1) The actress cursed the director and the producer threw his cigar on the floor.

Readers are indeed garden-pathed when an ambiguous fragment turns out to be an S-coordination. Self-paced reading and eye-movement experiments showed that the reading times of the disambiguating verb and the word following it were longer compared to a control sentence that was disambiguated earlier in the sentence by adding a comma after, in (1), *the director*. However, it was also found that the preference for this parse was modulated by verb-specific information (see Annual Report 1996).

Vonk and Hoeks investigated this issue further by having readers process the temporarily syntactically ambiguous sentence in a context which manipulated the topic-hood of the coordinated object of the target sentence, as in sentences (2) a context biasing towards S-coordination and (3) a neutral context).

- (2) When they saw the film as the director had edited it, the actress and the producer were very angry.
- (3) When at the end of the movie the credits appeared on the screen, the tension in the room had mounted.

Both *actress* and *producer* are topics in (2) and both are topics in the target sentence (1) throughout if they were already interpreted initially as an S-coordination. Off-line completion studies indicated that the proportion of sentence-coordinated completions of a sentence fragment of (1) increased dramatically when it was embedded in context (2) compared to embedded in context (3). In subsequent self-paced moving window and eye-tracking experiments, readers were garden-pathed when reading the target sentence in context (3), but not when reading it in context (2). Reading times and gaze durations/regression path durations, respectively, were longer at the syntactically disambiguating verb compared to the control sentence with comma in context (3), but not in context (2). The results indicate that pragmatic discourse information is used at a very early stage and can guide the processor in choosing an initial parse.

11.3.3 Subject relative *versus* object relative clauses

It is a well-established fact that subject-relative (SR) clauses, like (1) below, are easier to process than object-relative (OR) clauses, as in (2) below. (The original Dutch examples are given here in English gloss, preserving Dutch word order.)

(1) the sharks, that the diver have killed, (SR)

(2) the diver, that the sharks have killed, (OR)

Longer reading times were found when the auxiliary was encountered in (1) than in (2) (see Annual Report 1997). Most models predict that, in semantically neutral contexts, SR readings are preferred over OR readings. Different predictions are made for contexts in which semantic or pragmatic information biases either an SR or an OR reading. Some models predict, even in the presence of conflicting semantic information, that an SR reading is initially assigned and that a time-consuming revision takes place in case the auxiliary syntactically disambiguates in favor of an OR reading.

Vonk, Mak, and Schriefers investigated this issue by presenting semantic/pragmatic information that biases the interpretation of the relative clause before syntactic parsing of the clause can start. The animacy of the head noun was varied, as in (3) and (4). In (4), the head noun is not a likely agent, but a likely patient, biasing the relative clause reading to an OR interpretation.

(3) the sharks, that the sail boat destroyed have (SR)

(4) the sail boat, that the sharks destroyed have (OR)

In a self-paced moving window experiment and in an eye-tracking experiment, they found no difference in reading times or fixation/gaze durations, respectively, at any position in the relative clause, whereas the difference between (1) and (2) was replicated. This provides further evidence for the interplay between semantic/pragmatic and structural factors and suggests that in parsing a sentence with multiple possible parses, readers rely initially not only on structural preferences but also on semantic/pragmatic information.

They further investigated the influence of semantic/pragmatic information in an experiment in which indexical pronouns were the subject or the object of the relative clause, whereas the head nouns remained full NPs,

as in (5) and (6). The pronoun in this case marks its referent as the topic of the clause, which, in general, fulfills the role of the syntactic subject, biasing the relative clause reading to an OR interpretation.

(5) ...de keiner, die jullie gezien heeft,...(SR)

'the waiter, that you (pi.) seen has,'

(6) ...de keiner, die jullie gezien hebben,...(OR)

'the waiter, that you (pi.) seen have,'

In addition to the noncase-marked *jullie* ('you', pi.), the case-marked *wij lons* ('weTus') was presented in the relative clause. This pronoun thus disambiguates the relative clause at the pronoun itself. Preliminary analyses of a self-paced moving-window reading experiment indicate that when the relative clause contained the pronoun *jullie*, an initial OR parse is preferred over an initial SR parse. When the relative clause contained the pronoun *ons* in the SR-clause or *wij* in the OR-clause, the reading times did not differ at the auxiliary, indicating that the disambiguation took place earlier than at the auxiliary. The results show that readers use pragmatic discourse information in assigning an initial parse.

11.3.4 Inference processes and discourse integration

Vonk continued research on causal inferences with Cozijn and Noordman (Tilburg U.). In their previous research, it was found that on-line causal inferences depend on the knowledge of the reader. When the causal relations which had to be inferred are familiar to the reader, they are activated during reading and the inferences are made.

Target sentences expressing a causal relation between a main clause and a subordinate clause were presented in a text. After the target sentence, a probe from the first clause (the main clause) of the target sentence was presented for recognition. The target sentences varied in two ways: (1) with respect to the familiarity of the underlying causal relation, as was established in previous tests; and (2) with respect to the presence of the conjunction *because*. An inference is supposed to speed up the probe recognition.

The results indicated that only those inferences were made which were familiar and, therefore, available, and which were signalled by the causal conjunction. To further test the availability hypothesis, the same texts were used in an experiment in which additional information was given with

respect to the inference preceding the target sentence. This should increase the availability of the causal relation. Probe recognition times were shorter when the conjunction was present than when it was absent, not only for the familiar but also for the unfamiliar causal relations. Consequently, if the context increases the availability of the underlying causal relation, the inference is made. The results support the hypothesis that inferences depend on the familiarity of the causal relation in the text.

11.3.5 Evidentiality and the use of epistemic expressions

Nuyts (U. of Antwerp) and Vonk continued their investigation of the status of the 'subjectivity versus objectivity' dimension in epistemic evaluations and how it affects epistemic expressions (including adverbs, predicative adjectives, mental state predicates, and auxiliaries). This dimension can be understood in at least two different ways: (a) as involving the quality of the evidence for an epistemic evaluation (good *versus* weak evidence); or (b) the (inter)subjectivity of the evaluation (i.e. does the speaker assume personal responsibility for the evaluation or does he share the responsibility with others, particularly the interlocutor). An experiment was designed to test whether one or both of these interpretations actually affects the choice for a particular epistemic expression. The materials consisted of stories presenting evidence (varied for factors (a) and (b)) naturally leading to a conclusion by a protagonist. Four pilot experiments were conducted to test and improve the materials. The main experiment was performed in two versions. Some participants were asked to select among alternative epistemic expressions the one which best matches the type of evidence available. Other participants were asked to formulate a conclusion spontaneously. In both, there was no significant effect, neither of the interpretation (a) or (b), nor of the choice/use of epistemic expressions. It is likely that reading (b) must be interpreted in a more strongly interactive way than has been implemented in the experiment so far.

11.4 Language Production

11.4.1 Collateral language

During his visit at MPI from September 1997 to September 1998, H. Clark worked on what he calls collateral language. The idea is that the participants in any spontaneous discourse are engaged in two tracks of communication at the same time. Their primary actions are directed at the official business of the discourse. Yet they must also coordinate their

actions with each other, and that requires the forms of communication that H. Clark has called collateral language. The basic elements of collateral language are certain indexes based on the participants' spoken performance - its timing, location, vocalization, and packaging. But collateral language also includes such ancillary devices as fillers (e.g. *uh* and *urn*), editing expressions (e.g. *I mean* and *you know*), elongated syllables, non-reduced words (e.g. *the* pronounced as '*thee*'), and back channel responses (e.g. *uh huh* and *m*). It is concluded that these elements form a unified system, a genuine collateral language, that satisfies the requirements needed for coordinating spontaneous discourse.

11.5 Studies on Nasality in YeT Dnye

Levinson, on a field trip to Rössel Island (PNG), collected oral and nasal airflow data during the speech of three native speakers of YeT Dnye, the language isolate spoken on that island. The exceptionally large inventory of nasals and nasalized segments of this language provides not only a good place to study YeT Dnye contrasts but also a chance to collect data on a variety of nasal contrasts all within one language and with one set of speakers.

Walsh Dickey carried out a number of analyses of the airflow data, which included oral stops, nasal stops, prenasalized stops, and an unusual sound, previously described as 'nasal plosion' or a 'post-nasalized stop'. These four types of consonants were varied orthogonally with place of articulation and the nasality of following vowel.

A number of interesting findings were obtained. First, it was noted that nasal vowels display a crescendo of nasal airflow once the vowel has begun. This contrasts with findings of other nasal vowels, such as in French, which show nasalization throughout the vowel. It is likely that the great number of nasal contrasts in consonants necessitates strict separation of consonant and vowel nasality, leading to a small oral portion of a vowel which then builds nasalization throughout its duration.

The timing and airflow patterns observed in prenasalized stops gave empirical support to the claim that these are indeed single segments and not consonant clusters. The nasal plosion segments were discovered to be largely voiceless nasals, with very high nasal airflow turbulence. These sounds, rather than being post-nasalized stops, are better described (based on airflow and consonant inventory evidence) as pre-stopped voiceless nasals.

YeT Dnye had previously been described as having no nasality contrast on short vowels after nasal stops. This description was falsified, as this study uncovered a number of oral and nasal short vowel minimal pairs in this environment.

11.6 Pursuing problems of scope-sensitive particles

Bierwisch dealt with the following puzzle related to German *wieder* (and its equivalent in several other languages).

1. While the ambiguity of cases like (1) has been studied in fair detail, a related ambiguity in (2) has barely been noticed:

(1) Sie haben das Theater wieder geschlossen.

'They closed the theater again.'

(2) Der Hauptdarsteller war wieder krank.

The protagonist was ill again.'

Under the so-called repetitive reading, in (1) *wieder* induces the implicature that there was a previous event of closing the theater. Under the restitutive reading, it induces the implicature that the theater was previously in the state of being closed. These two options have been accounted for by the assumption that the operator AGAIN represented by *wieder* has different scope, applying either to the complete event specified by the clause, or only to the resulting state of this event. This may be represented as in (3)(a) and (b), respectively:

(3a) [AGAIN [X CAUSE [BECOME [CLOSED T]]]] (repetitive)

(3b) [X CAUSE [BECOME [AGAIN [CLOSED T]]]] (restitutive)

The interpretation of AGAIN would be something like (4):

(4) AGAIN P is true at f iff P is true at f; implicature: 3f

(f' before t & P is true at f)

There are different proposals as to how the alternative scope of AGAIN in (1) is to be derived. Whatever solution is adopted, however, it cannot account for the ambiguity of (2), as here no distinction between an event and its result is involved. The implicature induced by *wieder* in (2) is either that the actor was ill at previous occasion(s) (repetitive reading), or that he was healthy, before he returned to the earlier state of being ill (restitutive reading). Notice that under the repetitive interpretation of (2), no

interruption of the actor's sickness is implied: he might in fact have been ill all along between the different occasions. Suppose, as a first approximation, that a clause like (5a) specifies a situation *s* characterized by the assignment of the predicate *ILL* to the actor *P*, as indicated in (5b).

(5a) Der Hauptdarsteller ist krank, (b) 3s [s : ILL P]

The two readings of (2) could now be distinguished as in (6a) and (6b):

(6a) [AGAIN [3s [s : ILL P]]] (repetitive reading)

(6b) [3s [s : AGAIN [ILL P]]] (restitutive reading)

One might argue that the different readings of cases like (2) - and hence presumably also (1) - are not due to different semantic representations in the sense discussed here, but only to conceptual/pragmatic interpretation. Thus (1) and (2) would not be cases of ambiguity, but of underspecification, at best. This seems to be corroborated by cases like (7), where alternative readings are excluded for conceptual reasons:

(7) Der Präsident hat wieder eine Rede gehalten.

'The president gave a speech again'

This escape is not legitimate, however, since the ambiguity in question is related to linguistically determined formal properties. Focus accent distinguishes between the readings in question in non-trivial, but clear ways: (1) and (2) are ambiguous in the sense indicated by (3) and (6), respectively, if pitch accent is on the constituent following *wieder*, but they have only the repetitive reading, if pitch accent is on *wieder*. The same is true if the particle is reordered to the left (by whatever syntactic operation):

(8) Wieder haben sie das Theater geschlossen.

'Again, they closed the theater.'

(9) Wieder war der Hauptdarsteller krank.

'Again, the protagonist was ill.'

This observation shows that the different interpretation of *wieder* is not merely a matter of pragmatic interpretation, but depends on structural conditions in ways that are still in need of explanation, but seem to be characteristic of the computational structure of natural language.

12 OTHER ACTIVITIES

12.1 Activities of the Technical Group

12.1.1 Overview

1998 saw the completion of the technical outfitting of the newly renovated Institute building. The Technical Group (TG), therefore, was able to once again focus on new developments to facilitate scientific work. The TG concentrated on two areas in 1998:

- 1) adding functionality and new concepts to the area of linguistic computation; and
- 2) further work on the NESU experimental program.

In both areas, MPI has already created full-fledged and competitive tools which have proved to be of increasing interest to external scientists. Some programs (NESU, MediaTagger, MediaEditor) are now distributed worldwide. TG specialists presented this work at various conferences and meetings during 1998.

In 1998, the TG also worked on reducing the load needed to support external scientists. This was done with the help of very efficient network-based distribution mechanisms and list servers. The TG was, however, involved in helping and advising many "other collaborating Institutes set up their facilities. The amount of time invested in such external advising was substantial.

The remaining focal activity was setting up powerful server capacities and improving the connectivity of the Institute in order to be able to do archiving and generate multi-media streams across the network.

12.1.2 Computer Systems

The Institute bought two SMP servers from SUN in order to replace the aging HP servers and expand services. These servers, equipped with large disk space and a 3 TB tape library, will form the heart of the Institute's computer resources in the coming years. The tape library is to be used for three services: backing up, archiving, and HSM (Hierarchical Storage Management). The archiving service has become increasingly important for storing large data sets which are not in constant use; additionally, all published data is now archived in order to be available for later review. Backing up data from MAC and NT machines has also been centralized.

With respect to PC support, the Institute bought new NT-based servers which will be used to smoothly replace the aging Novell Netware servers. All PC and MAC users will have access to the centralized data, software, and print services of these NT servers.

12.1.3 Networks

In 1998, the Institute bought a router and got a new connection to the Dutch scientific network via the University of Nijmegen. The university is now linked with 155 MBPS to the Dutch scientific network and MPI is linked with 10 MBPS to the central router of the university. The new router operates as package filter to increase the security of the internal net.

It has become increasingly important for MPI employees to access the Institute's facilities from home. The frequency of access from external locations is on the rise. Therefore, the TG extended the number of ISDN ports on our Remote Access Server.

12.1.4 Information Systems

The MEID intranet was further improved by automating even more services, such as adding a function which allows the employees to continuously update information about their publications and presentations via standard input forms. This information is compiled into files so that it is always available for central activities, such as producing the Annual Report.

Two important search tools were implemented this year: an updated library catalog and access to scientific journals via the world wide web. A proxy server was installed in order to minimize the network load created by

accessing web pages and to better control this flow of data. A new CDROM server was installed which does disk caching in a way that allows users to efficiently access information in a multi-user environment. This service is accessible from all desktops in the Institute including PC, MAC and Unix workstations.

Very important to the efficiency of the work of the members of the TG was the extension of the central administrative database. This now covers all equipment which the technical group maintains (audio-visual, computers, electronic boxes, etc.). The system remains implemented with ORACLE and can be accessed by all members of the TG. The database is organized so that it is easy, for example, to generate equipment lists for scientists who are planning field trips.

12.1.5 Linguistic Applications

This is the area in which the TG has concentrated most of its development efforts. A number of programs were developed or updated in 1998: Media Tagger, MediaEditor, SEARCH, FastSearch, BrowsableCorpus, EUDICO, and many special purpose scripts.

MediaTagger (MT) was partly rewritten this year in order to make it a more stable and more useful tool for research in which immediate access to video information is necessary, either for analysis or for coding purposes. A viewer for the speech signal was added. The graphical database query interface was also rewritten to make it faster. The connectivity to the media-server was improved so that direct video streaming from the server disks is now possible. MT is heavily used by several researchers, especially for coding and analyzing gesture corpora.

MediaEditor (MED) is now a fully-developed tool for transcribing, coding, and analyzing corpora which are based on digitized speech. It supports simultaneous work in two tightly synchronized domains: The textual corpus and the speech wave.

In the textual domain, it supports the CHAT-format of Childes. In the speech domain, it primarily supports an MPI-developed speech tool which offers access to the speech wave and the pitch contour. Using this speech tool, MED is platform-independent, since it is written in Tcl/Tk and C++. On the UNIX platform, the Xwaves speech tool can be used, giving the same tight synchronization of domains. By using Xwaves, however, all

professional speech analysis functions (spectrograms, spectra, spectral envelopes, etc.) are available to the user.

Parallel to this development work, many corpora which have speech as raw material were expanded by digitized and labeled speech. For example, all English material from the ESF Second Learner corpus is now available at the user's desktop. We are currently working on French and German.

A powerful and flexible search tool, SEARCH, was developed which can handle CHAT, Shoebox, and standard text format. It allows the user to specify patterns which can be associated with tiers. Such patterns can be specified as regular expressions. Within these regular expressions, it is possible to use variables which are expanded during execution. The latter is very important, since it allows the users to work easily with exotic languages, using any transcription that they care to define. After having specified such patterns, they can be combined with the help of a logical language to create powerful search strings.

With FastSearch, the TG has begun testing the feasibility of fast, indexed-based searching on huge SGML-based corpora with a new technology.

BrowsableCorpus (BC) is a tool which is aimed at helping the researcher navigate the universe of corpora at MPI and eventually even in a global universe. The basis of BC is two-fold:

- 1) a directory structure is created which specifies a hierarchical ordering scheme for storing and finding files which have to do with the corpus world (raw media files, transcripts, code files, documents, etc.); and
- 2) a bundle of description files are created which contain meta-data about the corpus files, such as names of interviewers and subjects, age of subjects, languages. With the help of the method of abstraction, we are able to detect common features between certain description files and form hierarchies and clusters.

EUDICO is the linguistic tool of the future for the Institute. It is seen as the 'universal' work bench for linguists dealing with corpora. EUDICO is designed to be an open framework that is relatively easy to add further modules on to. The most interesting characteristics of EUDICO can be found in the following (not exhaustive) list:

- platform-independence (100% JAVA);

- format-independence (handles various well-known corpus formats such as CHAT, Shoebox, reDBMS);
- internet-based interactive operation, even for audio/video access;
- local operation if desired;
- various typical presentation formats such as coding-list and score-schemes;
- synchronized play of media streams (cursors on all viewers are dynamically updated and subtitling is dynamic);
- several media instances to allow easy comparison between video scenes or audio patterns;
- first search facilities; and
- down-line load of the client code.

After almost a year of development work, the first version of EUDICO, with the functionality mentioned above, was delivered and tested across the local area network and the Dutch scientific network. In these demonstrations, MPEG-coded video was transmitted seamlessly to the clients. This tool will improve scientific collaboration and reduce the costs of corpus-based work.

12.1.6 Experimental facilities

At the beginning of 1998, a lot of work was still to be done to prepare all of the experimental rooms for optimal use. The Institute now has 11 experimental rooms and 3 observation labs. With the exception of the group experimental room, all experimental rooms are equipped with sound-proof booths and standard NESU setups (NESU is the robust, time-accurate, powerful, and flexible experiment generator developed at MPI). Two experiment rooms were equipped for multi-subject gating experiments also making use of the NESU software.

A second ERP-lab was equipped with modern multi-channel (32) Synamp amplifiers to register ERP signals. The old amplifiers were used to build up a portable ERP measurement station which can be easily hooked up to PET, MEG, or MRI equipment at other institutions. The ERP labs are also controlled by the NESU software. To improve these experiments, the TG developed a tight synchronization between the Synamp box and the

NESU master PC as well as a method to include variable synchronization markers (256 different markers) into the EEG data stream.

The NESU software was expanded in 1998, adding a number of interesting features, including the use of a mouse as a reaction device, moving picture experiments, hotspot-areas on the screen selectable by a mouse, tone generation by the SoundBlaster board/sound chips, and multi- subject gating. Using NESU with disk-based sound output is now also possible on notebook computers which have the ESS sound chip set. There were two further enhancements of NESU. One is the extension of the eyetracking experiments to allow eye-based feedback, so that the position of the eye can be used to manipulate the display content in real time. The other was a picture database which gives experimenters easy access to frequently used picture stimuli.

The current NESU version is still based on MSDOS and an old version of Smalltalk. A lot of time was spent in porting the NESU software package, which was developed in the object-oriented language Smalltalk, to Windows NT. Further, the follow-up version of the NESU hardware box was designed. Due to the high demand for these boxes and the limited capacities in the electronic lab of the Institute, we decided to co-operate with a small electronics company in the manufacture of this hardware.

12.1.7 Audio/Video facilities

In 1998, the TG set up two new observation labs: the motion lab and a third eyetracking lab for use of a head-mounted eyetracker. The motion lab is equipped so that the behavior of subjects can be recorded by 4 synchronized video cameras. A video-mixer, together with an audio delay unit, allows the experimenter to do split screen recordings. Additionally, ultrasonic-based gesture recording equipment can be hooked up to the setup so that synchronization markers in the data stream will facilitate later analysis work.

The whole video lab had to be reconstructed because the old video equipment with outdated video formats and the hard-wired editing system had to be removed. Newly-bought digital video recorders were put in place. Currently, we support VHS, S-VHS, Hi-8, UMatic, and DVCAM formats and the PAL and NTSC norms; the lab can now be used again to generate copies translated from one format to another. A lot of support from specialists is needed to copy time code information and the audio

signals in an appropriate way. A huge amount of copying and digitization work was carried out by the TG in 1998.

Digital camcorders were added to the field equipment. One of the questions we had was how this technology would behave under the extremes of field work. In total, 12 expeditions were prepared and equipped in 1998. When the equipment was returned, it was checked extremely carefully to determine whether it could be used for another expedition. All essential equipment had to undergo a time-consuming cleaning, adjustment, and function check procedure. A broad discussion with all field workers in the Institute revealed that most equipment operated well, that the solar-packs were very useful in many instances, but that the DAT audio recorders and the rechargeable batteries had many problems. Recorders applying the helical scan technique suffered more from extreme humidity than traditional ones. With respect to the rechargeable batteries, we found that the new types of Lithium-based ones had fewer problems than the older models.

12.2 CELEX: The Center for Lexical Information

Because of limited government funding, CELEX, the Dutch Center for Lexical Information, entered a period of consolidation in 1998. The plan was to maintain CELEX as a resource for the academic world for at least three more years by concentrating on administrative activities, such as account management and help desk operations, while keeping an eye out for linguistic projects that CELEX might be integrated into as a lexical module. No large-scale self-contained development will be undertaken, apart from completion of a new version of the German database and minor revisions and extensions to the Dutch database on the basis of earlier groundwork. The main task associated with CELEX will be integration of the lexicon into the framework of the Dutch-Flemish Spoken Corpus Project from 1999 onwards.

For this purpose, Piepenbrock's assignment as CELEX project manager was combined with an appointment to the one-year pilot stage of the Spoken Corpus Project. Activities during this stage included making a survey of state-of-the-art electronic spoken corpora collection and encoding, as well as producing a report on the status of available computational lexicons and how they could be modified to enrich transcribed spoken data.

Meanwhile, work progressed on the German and Dutch databases throughout 1998- Borgwaldt, who continued her work as the German database developer, improved database consistency by tightening up constraints and adding secondary flections and alternative morphological segmentations. She also conducted a preparatory study on the disambiguation of word forms by specifying meaning distinctions between homonyms and contextual criteria for assigning converted lemmata to their various word classes.

In April, Piepenbrock released a new version 3.2 of the Dutch database, revised in accordance with the recent Dutch spelling reform. This boasts more than 5500 adapted word form entries and labels provided to indicate the status of the orthographic form and the type of spelling rule that obtains. Furthermore, an n-gram and n-phone frequency calculation program was installed on the CELEX system in order to provide users with an easily operable extension to the standard lexical query mechanism. Finally, Piepenbrock made preparations for adding imageability ratings and pronunciation variants to the Dutch database at a later stage.

12.3 Nijmegen Lectures

The 1998 Nijmegen Lectures were given in December by William Labov (U. of Pennsylvania). The title of the series was 'Linguistic Change: Some Solved and Unsolved Problems' and the topics covered the mechanism of linguistic change, cognitive problems in linguistic change, and the relation of variation studies to current linguistic theory. The international response to the series this year, as reflected by the very high numbers of inquiries and registrations, was remarkable.

The series was divided into three morning lectures and three afternoon seminars. The lectures were entitled: 'Accounting for the growing diversity of North American English dialects,' 'The transmission of change across generations,' and 'Can optimality theory deal with linguistic variation? The issue of transparent versus opaque constraints.'

The seminars offered the audience and invited discussants a chance to pose questions and engage in general discussion of the issues. The titles of the seminars were: 'The gender paradox: women as sociolinguistic conservatives and radicals,' 'The asymmetry of production and perception,' and 'The surprising Constant Factors Effect in syntactic change. The competing grammars model versus inherent variation.' The invited discussants included: Dave Britain (U. of Essex), Anne Cutler

(MPI), Marinel Gerritsen (U. of Nijmegen), Dick Hudson (U. College London), Pieter Muysken (U. of Leiden), and Hans van de Velde (U. Libre de Bruxelles).

The lectures were organized by the Institute in co-operation with the Interfaculty Research Unit for Language and Speech (IWTS) of the U. of Nijmegen. The series organizers were Walsh Dickey (Chair; MPI), Ameka (MPI), Van Hout (U. of Nijmegen), and Neijt (U. of Nijmegen), with secretarial assistance from Jonas.

12.4 The F.C. Donders Lectures on Cognitive Neuroscience

This lecture series is organized by C. Brown and Hagoort, in collaboration with the Nijmegen Institute of Cognition and Information (NICI). Speakers in the 1998 series were: Stephen M. Kosslyn (Harvard U.), Karl Zilles (Heinrich Heine U, Düsseldorf), Leslie G. Ungerleider (National Institute of Mental Health, USA), Jon Driver (U. of London), and Jacques Mehler (Laboratoire de Sciences Cognitive et Psycholinguistique (CNRS), France).

12.5 Neurocognition of Language book project

C. Brown and Hagoort completed editing the book *The Neurocognition of Language*. The book is being published by Oxford University Press and will be on the market in the spring of 1999. The book contains state-of-the-art overviews of speaking, listening, and reading, and of the ways in which these functions are instantiated in the brain. In addition, it contains overviews of the most recent methods of analyzing data from brain imaging techniques such as PET, fMRI, MEG, and ERP, for the purpose of advancing the neurobiology of language.

12.6 Netherlands Center for Cognitive Neuro-Imaging

Hagoort coordinated the activities of a panel committee which was asked by the Dutch Ministry of Education, Culture, and Science (OCW) to provide a document with the outline of a Dutch center for cognitive neuro-imaging. Other members of this committee are Frackowiak, De Haan, Mulder, Raaijmakers, and Zilles. In addition, both OCW and the Netherlands Organization for Scientific Research (NWO) have asked this committee to initiate and monitor the progress towards the realization of a Dutch facility for cognitive neuro-imaging. On the basis of the document that the committee provided, interested parties have been asked to submit detailed plans for such a center.

12.7 Honors

Baayen was awarded an NWO PIONEER project on the balance of storage and computation in the lexicon. This award will fund a research group of six scientists in IWTS.

Bohnenmeyer received a cum laude doctorate from Tilburg University.

C. Brown received the Visiting Scientist Award from the McDonnell-Pew Center for Cognitive Neuroscience at the University of California, San Diego.

Gretsch received a summa cum laude doctorate from Tübingen University.

Levelt received a knighthood (Ridder in de Order van de Nederlandse Leeuw) for general services to the field of psychology of language.

Levinson delivered the Stem Lectures, Gothenburg, Sweden.

Schiller was awarded an Otto-Hahn Medal for one of the outstanding dissertations from young scientists in the Max-Planck-Gesellschaft

Senft became 'außerplanmäßiger Professor' at the University of Cologne.

Sereno was awarded an Alexander von Humboldt Research Fellowship.

12.7.1 Internal lectures and colloquia

Colloquia organized by the Institute's colloquium committee and Heeschen included lectures by Besson (CNRS, Marseille), Tomasello (Emory U. and MPI for Evolutionary Anthropology), Marcel (MRC, Cambridge), H. Clark (Stanford U.), Shankweiler (U. of Connecticut), Woodbury (U. of Texas at Austin), Ladefoged (UCLA), Kay (UC Berkeley), and McNeill (U. of Chicago). Many informal lectures were also given by long-term and occasional visitors to the Institute.

12.8 Teaching

The staff of the Institute taught courses at the following institutions:

- Baayen (Nordic Academy for Advanced Studies, Finland; Ecole d'été morphologie, France).
- Brown, C. (U. of Nijmegen).
- Brown, P. (UCLA).

- Clark, E. (Graduate School of Language and Communication Odense University, Denmark).
- Hagoort (Graduate School Neurosciences, Amsterdam; U. of Gent; U. of Maastricht; U. of Nijmegen).
- Hendriks (U. of Paris XIII).
- Indefrey (U. of Düsseldorf).
- Klein (U. of Heidelberg).
- Roelofs (Winterschool of the Netherlands Graduate School of Linguistics (LOT); U. of Leiden).
- Ruiters (U. of Nijmegen).
- Senft (U. of Cologne).
- Vonk (U. of Nijmegen).
- Wittenburg (U. of Nijmegen).

12.9 Colloquia presented

The following members of the Institute and visitors (during their time at the Institute) presented colloquia at various institutions:

- Bergsma (U. of Nijmegen).
- Bowerman (Interuniversity Developmental Colloquium Series, Tokyo; SUNY Buffalo; Northwestern U.).
- Brown, C. (The Salk Institute, La Jolla; James S. McDonnell Foundation Summer Institute in Cognitive Neuroscience, USA).
- Brown, P. (U. of Konstanz).
- Clark, E. (U. of Utrecht; Koninklijke Nederlandse Akademie van Wetenschappen, Amsterdam; Ecole Pratique des Hautes Etudes; U. of Bergen; U. of Groningen; U. of Tel Aviv).
- Cutler (U. Libre de Bruxelles, Chinese U. of Hong Kong).
- Gretsch (U. of Tübingen).
- Hagoort (U. of Gent; U. of Arizona, Rice U. Houston; Albert Einstein College of Medicine, New York; CUNY Graduate School, New York; Academic Hospital Utrecht).

- Heeschen (RWTH, Aachen).
- Indefrey (U. of Rotterdam; NIH, USA; Heinrich-Heine-U., Düsseldorf; Summer Institute in Cognitive Neuroscience, USA).
- Janssen, D. (MIT; Beckman Institute, USA).
- Jongman (U. of Kansas).
- Kita (U. of Bielefeld; National Institute of Multi-Media Education, Makuhari, Japan; Japan Women's U., Tokyo).
- Klein (European Research Conference, Maratea).
- Meyer (Birkbeck College; U. of Nottingham; U. of Birmingham; U. of Bonn; Rice U.).
- Özyürek (Northwestern U.; Koc U., Istanbul).
- Roelofs (U. of Southampton; University College London).
- Senft (U. of Nijmegen; U. of Amsterdam; U. of Kiel; U. of Papua New Guinea, Port Moresby).
- Sereno (U. of Kansas).
- Smits (Institute for Perception Research, Eindhoven).
- Van Geenhoven (U. of Amsterdam; U. of Nijmegen).
- Vonk (U. of Louvain-la-Neuve).
- Walsh Dickey (U. of Utrecht).

12.10 Workshops organized

P. Brown, Bowerman and Allen organized a workshop at the Institute entitled 'Cross-linguistic Perspectives on Argument Structure: Implications for Learnability'. The workshop, held June 26-29, included presentations by members of the Argument Structure Project together with commentaries by invited discussants E. Clark (Stanford U.), Goldberg (U. of Illinois), Fisher (U. of Illinois), Hale (MIT) and Levin (Northwestern U.).

Cutler, Flores d'Arcais, Hagoort, Klein, Levinson and Meyer organized the workshop 'A Debate on Language and the Brain' in May, at MPI in honor of Levelt's 60th birthday. Participants were Mehler (CNRS), Dennett (Tuft U., Medford), Morton (U. College London), Pinker (MIT) and Marshall (Redcliffe Infirmary, Oxford).

Ide, (Japan's Women's U.), Yoshimi, (U. of Hawaii), and Kita organized a panel entitled 'East Asian Discourse and cultural ideology' at the 6th International Pragmatics Conference in Reims, France, in July. The papers were presented by the organizers, in addition to Saft (Hokkaido Tokai U.), Fiksdal (Evergreen State College), and Strauss (UCLA). Hymes (U. of Virginia) was the discussant.

Ide and Kita also organized a workshop in September entitled 'How and why language use instantiates harmony?: The case of backchannels and sentence final particles', at Japan Women's U. in Tokyo. The papers were presented by the organizers, in addition to Saft (Hokkaido Tokai U.), Katagiri (ATR), Arai (Japan Women's U.), Sakurai (Japan Women's U.), Miyata (Aichi Shukutoku Junior College), Nishisawa (Tokiwa U.), and Horie (Tohoku U.).

In collaboration with Van der Sandt of the U. of Nijmegen, Van Geenhoven was the co-organizer of a monthly semantics colloquium which took place at the U. of Nijmegen.

Senft organized a workshop on 'Spatial Deixis in Austronesian Languages', which was held in Nijmegen on November 6-7. Papers on aspects of spatial deixis in Taba, Kilivila, Pileni, Iaai, Nelemwa, Samoan, Tongan and languages of Central Vanuatu were presented by Bowden (MPI), Senft (MPI), Naess (U. of Oslo) Ozanne-Rivierre (CNRS, Paris), Brill (CNRS, Paris), Mosel (U. of Kiel) Broschart (U. of Köln), and Charpentier (CNRS, Paris).

Wilkins organized the Third International Workshop on Australian Aboriginal Languages, which was hosted by the Language and Cognition Group of MPI (28-29 April). The workshop examined event representation, verb semantics, and argument structure in Australian Aboriginal languages, and special attention was given to the description of motion events. Papers were presented by Austin (U. of Melbourne), Evans (U. of Melbourne), McGregor (KU. Leuven), Nash (AIATSIS), Nicolas (U. de Paris), Nordlinger (U. of Melbourne), Schultze-Berndt (MPI), Simpson (U. of Sydney), Wilkins (MPI), and Wilson (U. of Sydney).

The Technical Group organized two workshops. Wittenburg and Redeker organized a workshop entitled 'Constructing and Accessing Multi-Media Corpora: Developments in and around the Netherlands' (Nijmegen, February). Wittenburg organized 'XML-a Future Standard for Document Handling in the Internet' (Nijmegen, May).

12.11 Presentations at conferences, congresses, and workshops

- Allen, S.E.M. 'Discourse effects in early null argument asymmetries'. 72nd Annual Meeting of the Linguistic Society of America. New York, January.
- Allen, S.E.M. 'Linguistic change in Inuktitut narratives across ages'. Winter Meeting of the Society for the Study of the Indigenous Language of the Americas. New York, January.
- Allen, S.E.M. 'Learning about argument realization in Inuktitut and English: Gradual development in the use of non-ellipsed forms'. Workshop on Cross-linguistic Perspectives on Argument Structure: Implications for Learnability. Nijmegen, June.
- Allen, S.E.M., Schroeder, H. and Crago, M.B. 'Indicators of language development and loss in Inuktitut narratives'. 11th Inuit Studies Conference, University of Greenland. Nuuk, September.
- Ameka, F.K. 'Likpe ways of packaging spatial information'. Workshop on Kwa Languages of Ghana. Leiden, May.
- Ameka, F.K. 'S/He died old dying to be dead right': Transitivity and semantic shifts of DIE in Ewe'. Workshop on Cross-linguistic Perspectives on Argument Structure: Implications for Learnability. Nijmegen, June.
- Ameka, F.K. 'Verbs of spatial configuration in Likpe'. 21st West African Languages Congress. Abidjan, July.
- Baayen, R.H. 'LNRE models'. Computationally Intensive Methods in Quantitative Linguistics. Glasgow, October.
- Baayen, R.H. and Schreuder, R. 'War and peace: morphemes and full forms in a non-interactive activation parallel dual route model'. 1st International Conference on the Mental Lexicon. Edmonton, September.
- Baayen, R.H. and Schreuder, R. 'The balance of storage and computation in the mental lexicon: The case of morphological processing in language comprehension'. The Utrecht Congress on Storage and Computation in Linguistics. Utrecht, October.

- Baayen, R.H. and Tweedie, F.J. 'A mixture model for a uni-modal word frequency distribution'. ALLC-ACH Joint Conference. Debrecen, July.
- Berkum, J.J.A. van, Brown, C. M. and Hagoort, P. The interaction of grammatical gender and discourse context during sentence parsing: Evidence from event-related brain potentials'. Workshop on the Processing of Grammatical Gender. Leipzig, July.
- Berkum, J.J.A. van, Hagoort, P. and Brown, C. M. 'Rapid discourse context effects in sentence processing: ERP evidence'. 11th Annual CUNY Conference on Human Sentence Processing. New Brunswick, March.
- Berkum, J.J.A. van, Hagoort, P. and Brown, C. M. 'Semantic integration for sentences or stories: Evidence from the N400'. 4th Conference on Architectures and Mechanisms of Language Processing (AMLAP-98). Freiburg, September.
- Bierwisch, M. 'Wissenschaften im Vereinigungsprozeß - Versuch einer Bilanz'. Akademievorlesung. Teil des Berichts der Arbeitsgruppe Wissenschaften und Wiedervereinigung. Berlin-Brandenburgische Akademie der Wissenschaften. Berlin, January.
- Bierwisch, M. 'Das Organ des Denkens und die Grenzen des Ausdrückbaren'. Akademiesymposium 'Werkzeug Sprache', Sächsische Akademie der Wissenschaften. Leipzig, January.
- Bierwisch, M. 'Lexical Entries for Focus Particles'. Semantics Workshop. Stanford, December.
- Bierwisch, M. 'Linguistik am Ende des Jahrhunderts: Die neue Unübersichtlichkeit'. Ringvorlesung. Graduiertenkolleg. Berlin, December.
- Bierwisch, M. 'Modularity of language - new perspectives on a traditional theme'. CSLI COGLUNCH Seminar Series on Cognitive Science. Stanford, December.
- Boettner, M. 'Number in Peirce grammar'. Relational Methods in Logic, Algebra and Computer Science. 4th. International Seminar. Warsaw, September.
- Bohnemeyer, J. The pitfalls of getting from here to there. Bootstrapping the syntax and semantics of motion event expressions in Yucatec

- Maya'. Workshop on Cross-linguistic Perspectives on Argument Structure: Implications for Learnability. Nijmegen, June.
- Bowerman, M. 'Language development and conceptual development'. (Plenary Lecture). Interuniversity Conference on Cognitive Development and Conceptual Development. Tokyo, January.
- Bowerman, M. 'Form-meaning mapping in first language acquisition: Where do children's early meanings come from?' Distinguished Speaker Series, SUNY Buffalo Center for Cognitive Science. Buffalo, NY, April.
- Bowerman, M. 'On language acquisition'. (Plenary Lecture.) Congress on Ways of World-making: The Reality of Constructivism II. Heidelberg, May.
- Bowerman, M. 'When nonlinguistic cognition meets cross-linguistic variation: On the construction of spatial meanings in first language acquisition'. Workshop on Whither Whorf? Northwestern U., Evanston, May.
- Bowerman, M. and Croft, W. 'The acquisition of the English causative alternation'. Workshop on Cross-linguistic Perspectives on Argument Structure: Implications for Learnability. Nijmegen, June.
- Brown, C. M., Turenout, M. van, and Hagoort, P. 'Brain activity during speaking: From gender to phonology in 40 milliseconds'. Workshop on Grammatical Gender. Leipzig, July
- Brown, P. 'Everyone has to lie in Tzeltal: Threats, lies and videotape in a Mayan society'. 1998 CLIC GSA Conference on Language, Interaction and Culture. Los Angeles, May.
- Brown, P. 'Verb specificity and argument realization in Tzeltal child language'. Workshop on Cross-linguistic Perspectives on Argument Structure: Implications for Learnability. Nijmegen, June.
- Brown, P. 'Lies and persuasion in Tzeltal: The rhetoric of childrearing'. 5th Biennial EASA Conference. Frankfurt, September.
- Brown, P. 'Everyone has to lie in Tzeltal'. 97th Annual Meeting, American Anthropological Association. Philadelphia, December.
- Brugman, H. G. and Kita, S. 'CAVA: Using a relational database system for a fully multimedial gesture corpus'. Constructing and Accessing

- Multi-Media Corpora: Developments in and around the Netherlands. Nijmegen, February.
- Brugman, H.G., Rüssel, A., Wittenburg, P. and Piepenbrock, R. 'Corpus-based research using the Internet'. Workshop on Distributing and Accessing Linguistic Resources. Granada, May.
- Brugman, H.G., Rüssel, A. and Wittenburg, P. 'An infrastructure for collaboratively building and using multimedia corpora in the humaniora'. ED-MEDIA/ED-TELECOM Conference. Freiburg, June.
- Brugman, H.G., Rüssel, A. and Wittenburg, P. 'EUDICO - A framework for multimedia corpora and corpus tools'. DV-Treffen der MPG. Göttingen, November.
- Clark, E. 'Approches du Sens: Formation interdisciplinaire en semantique des langues'. Association pour la Recherche Cognitive & le CNRS Formation Permanente, Delegation de Normandie. Asnelle-sur-Mer, January.
- Coppola, M., Newport, E. L., Supalla, T. and Senghas, A. 'Aspect and number marking in family-based gesture systems in Nicaragua'. International Conference on Theoretical Issues in Sign Language Research (TISLR). Washington D.C., November.
- Cutler, A. 'Possible and impossible words'. From Speech Perception to Word Learning. Vancouver, June.
- Cutler, A. 'Is there HAM in your HANDBAG? What speakers say and what listeners hear'. Australian Speech Science and Technology Association, Student Day (Invited Address). Sydney, November.
- Dell, G.S., Reed, K.D., Adams, D.R. and Meyer, A.S. 'Speech errors, phonotactic constraints, and recent experience'. 39th Annual Meeting of the Psychonomic Society. Dallas, November.
- Dickey, M.W. and Vonk, W. 'Verb-cluster sentences in Dutch: An on-line study'. 72nd. Annual Meeting of the Linguistic Society of America. New York, January.
- Dimroth, C. and Watorek, M. 'Focus, scope, and the learner variety approach'. 2nd International Conference on the Structure of Learner Language. Acquafredda di Maratea, September.

- Drozd, K.F. 'The weak quantification hypothesis'. Scuola Internazionale Superiore di Studi Avanzati (SISSA) Workshop. Trieste, September.
- Drozd, K.F. 'Presuppositional quantification, plausible dissent, and the development of children's pragmatic competence'. 23rd Annual Boston University Conference on Language Development. Boston, November.
- Drozd, K.F. and Loosbroek, E. van 'Dutch children's interpretation of focus constructions'. 23rd Annual Boston University Conference on Language Development. Boston, November.
- Gruber, O., Indefrey, P., Posse, S., Steinmetz, H. and Kleinschmidt, A. 'Dissociating the neural correlates of cognitive components in mental calculation: An fMRI study'. 4th International Conference on Functional Mapping of the Human Brain. Montreal, June.
- Hagoort, P. 'Localization of language functions'. 160th Scientific Meeting of the Dutch Society for Anatomy. Lunteren, January.
- Hagoort, P. 'PET- en fMRI-onthullingen over de neurale architectuur van taal'. Meeting of the NWO Research Group Biological Psychology. Utrecht, March.
- Hagoort, P. 'The interplay between syntax and semantics: Evidence from P600/SPS and N400'. EPIC XII. Boston, July.
- Hagoort, P. 'When gender gets hit by meaning'. Workshop on Grammatical Gender. Leipzig, July.
- Hagoort, P. 'Wat de hersenen verteilen over taal'. Publieksdag Hersenonderzoek (in the context of the Decade of the Brain). Congresscentrum Jaarbeurs. Utrecht, September.
- Hagoort, P. 'Wat de hersenen verteilen over taal'. NRC-Cognitive Science Conference for Aios, Oios and Postdocs. Nijmegen, September.
- Hagoort, P. 'Electrophysiology of language in healthy subjects and aphasic patients'. Symposium Electrophysiologie in der Neurologie, Neurochirurgie und Psychiatrie RWTH Aachen. Aachen, December.
- Hagoort, P. 'De gereedschapskist van de cognitieve neurowetenschap'. Symposium Dutch Society for Psychonomics (NVP): Kijken naar het actieve brein. Utrecht, December.

- Hamann, C. 'Die dysgrammatische Satzstruktur im Deutschen und die gestörte Interpretation komplexer Zeiten'. Talk and Colloquium as part of the requirements for the Habilitation. U. of Tübingen, May.
- Hamann, C. 'Natural Language Acquisition: Subject Omission and Root Infinitives'. BCN Summerschool. U. of Groningen, June-July.
- Heinzel, U. 'The acquisition of scope marking in German L1'. EUROSLA 8. Paris, September.
- Hendriks, H. 'Et la maman qui rentre à la maison avec un ver de terre: Left dislocation in French child first language and adult second language acquisition'. EUROSLA 8. Paris, September.
- Hendriks, H. 'Story construction in L1 and L2 acquisition: What adults know and children still have to acquire (and vice-versa)'. International Conference on Children's Discourse from a Narrative Perspective: Action and Consciousness in Story Construction. Kazimierz Dolny, September.
- Hendriks, H. 'Topicalization in French and Chinese narrative discourse: Comparison of L1 and L2 acquisition'. 2nd International Conference on the Structure of Learner Language. Acquafredda di Maratea, September.
- Hoeks, J.C.J, and Vonk, W. 'Processing coordination in context'. 10th European Society for Cognitive Psychology Conference. Jerusalem, September.
- Indefrey, P. 'Methoden der Lokalisation kognitiver Prozesse - PET', Tagung für experimentelle Psychologie. Marburg, April.
- Indefrey, P. 'PET studies naar hersenactiviteit tijdens syntactische verwerking'. Symposium Dutch Society for Psychonomics (NVP): Kijken naar het actieve brein. Utrecht, December.
- Indefrey, P., Gruber, O., Brown, C.M., Hagoort, P., Posse, S. and Kleinschmidt, A. 'Lexicality and -not syllable frequency determines lateralized premotor activation during the pronunciation of word-like stimuli - an fMRI study'. 4th International Conference on Functional Mapping of the Human Brain. Montreal, June.

- Janssen, D.P. and Roelofs, A. 'Verbal past tense forms support inflectional frames in language production'. 1st International Conference on the Mental Lexicon. Edmonton, September.
- Janssen, D.P. 'De productie van inflectionele en derivationale vormen'. Morfologiedagen 1998. Nijmegen, November.
- Janssen, D.P. 'Inflectional frames in language production'. 39th Annual Meeting of the Psychonomic Society. Dallas, November.
- Janssen, D.P. 'The relativity of storage versus computation in producing language'. The Utrecht Congress on Storage and Computation in Linguistics. Utrecht, November.
- Jongman, A. 'Some unexplored properties of lexical representations: Effects of speaker, rate, and semantic context in speech perception'. Lexical Representations in Language Comprehension. Konstanz, December.
- Jongman, A., Sereno, J.A., Wayland, R. and Wong, S. 'Acoustic characteristics of English fricatives'. 135th Meeting of the Acoustical Society of America. Seattle, June.
- Karreman, J. and Vonk, W. 'Het verwerken van relatieve bijzinnen in het Nederlands (I)'. 21 e Minisymposium over Lezen. Nijmegen, May.
- Kita, S. 'Linking underspecification and multi-tiered semantic representation'. Cross-linguistic Perspectives on Argument Structure: Implications for Learnability. Nijmegen, June.
- Kita, S. 'Verbalization of thought and speech accompanying gesture'. (Plenary Lecture) 15th Japanese Cognitive Science Society Meeting. Nagoya, June.
- Kita, S. 'Japanese ideology of conversation and its structural manifestations: A study of aiduchi and head nods'. 6th International Pragmatics Conference. Reims, July.
- Kita, S. 'Japanese ideology of conversation and its structural manifestations: A study of aiduchi and head nods'. Workshop on How and Why Language Use Instanciate Harmony? The Case of Backchannels and Sentence Final Particles. Tokyo, September.

- Kita, S. 'Cognitive processes underlying the generation of co-speech iconic gestures'. Orage 98: Speech and Gesture in Multi-modal Communication and Interaction. Besangon, December.
- Kita, S., Danziger, E. and Stolz, C. 'Cultural specificity of spatial Schemas, as manifested in spontaneous gestures'. Spatial Schemas in Abstract Thought. Munich, July.
- Kita, S. and Özyürek, A. 'Representing directionality by gestures in narrative discourse'. The Semantics and Pragmatics of Everyday Gestures. Berlin, May.
- Kita, S. and Özyürek, A. 'Linguistic effect on representation of motion in co-speech iconic gestures: A comparison of English, Turkish, and Japanese'. Orage 98: Speech and Gesture in Multi-modal Communication and Interaction. Besangon, December.
- Klein, W. 'Was kann die Zweitspracherwerbsforschung uns über die menschliche Sprachfähigkeit sagen?' Antrittsvorlesung Humboldt University. Berlin, June.
- Klein, W. 'The contribution of second language acquisition research'. Language Learning Jubilee Symposium. Ann Arbor, September.
- Klein, W. 'Genetically transmitted information and experientially transmitted information in the human language faculty'. Pontifical Academy of Sciences. Vatican City, October.
- Koster, C. and Drozd, K.F. 'Dutch children's understanding of bound variable constructions'. 29th Meeting of the Northeast Linguistics Society (NELS). Newark, October.
- Krämer, I. 'The interpretation of scrambled and unscrambled object NPs by Dutch children: Late acquisition'. TIN-dag (Taalkunde in Nederland). Utrecht, January.
- Krämer, I. 'De interpretatie van indefinieten door Nederlandse kinderen'. 10e Symposium Netwerk Eerste Taalverwerving. Leuven, April.
- Krämer, I. 'Indefinite subject NPs and negation in the interpretation of Dutch children'. Center for Language Studies Opening of the Academic Year 1998/1999. Tilburg, October.

- Krämer, I. 'Negation and the acquisition of 'specific' indefinites'. [Negation: Syntax, Semantics and Pragmatics]. North West Centre for Linguistics. 1st Annual International Conference. Salford, November.
- Levelt, W.J.M. 'Introduction: Language section'. The 1998 James S. McDonnell Foundation, Summer Institute in Cognitive Neuroscience. Dartmouth Medical School, Squaw Creek, CA, June -July.
- Levelt, W.J.M. 'Where do spoken words come from? A meta-analysis'. Neuroscience and Society, International Symposium College de France. Paris, October.
- Levelt, W.J.M. 'The speaking mind/brain: Where do spoken words come from?' The 1st Mind Articulation Symposium on 'Image, Language, Brain'. Tokyo, November.
- Levinson, S.C. 'Semantic representations versus conceptual representations: What is the relation between how we talk and how we think?' The Gustaf Stern Memorial Lectures on Semantics, University of Gothenburg, March.
- Levinson, S.C. 'The semantics and cognition of space in a cross-linguistic perspective'. The Gustaf Stern Memorial Lectures on Semantics. University of Gothenburg, March.
- Levinson, S.C. 'Pragmatics and semantics: Default inferences and the gap between what we say and what we think'. The Gustaf Stern Memorial Lectures on Semantics. University of Gothenburg, April.
- Levinson, S.C. 'Language and selection'. Lustrumcongres 'Grenseloze Selectie'. Nijmegen, October.
- Levinson, S.C. 'Language as nature and language as art'. Symposium on 'Changing concepts of nature and the turn of the millennium'. Pontifical Academy of Sciences. Vatican City, October.
- Mak, W.M., Vonk, W. and Schriefers, H.J. 'Het verwerken van relatieve bijzinnen in het Nederlands (II)'. 21 e. Minisymposium over Lezen. Nijmegen, May.
- Margetts, A. (formerly Keusen) 'Give' verbs in Saliba (Western Oceanic, Papua New Guinea). Workshop on Cross-linguistic Perspectives on Argument Structure: Implications for Learnability. Nijmegen, June.

- Mauth, K. 'Morphology and the segmentation of spoken language'. Morfologiedagen. Nijmegen, November.
- McQueen, J.M. and Cutler, A. 'Spotting (different types of) words in (different types of) context'. 5th International Conference on Spoken Language Processing. Sydney, December.
- Meulen, F.F. van der and Meyer, A.S. 'Viewing and describing pictures: the coordination of eye movements and speech planning in the production of noun phrases and pronouns'. 10th Congress of the European Society for Cognitive Psychology. Jerusalem, September.
- Meyer, A.S. 'Allocation of attention in picture naming'. Experimental Psychology Society (EPS) Workshop on Lexical Aspects of Language Production. Exeter, September.
- Meyer, A.S. 'The coordination of eye movements and speech planning in picture description'. AMLaP-98. Freiburg, September.
- Meyer, A.S. and Meulen, F.F. van der 'Lexikalische Einflüsse auf die Steuerung von Blickbewegungen bei der Bildbenennung. 40. Tagung experimentell arbeitender Psychologen. Marburg, April.
- Meyer, A.S. and Meulen, F.F. van der 'Eye movements during the production of nouns and pronouns'. 39th Annual Meeting of the Psychonomic Society. Dallas, November.
- Müller, O., Fransen, H. and Meyer, A.S. 'Pupillometrie während einer Satzergänzungsaufgabe. 40. Tagung Experimentell arbeitender Psychologen. Marburg, April.
- Özyürek, A. 'Differences in speech and gesture organization in English and Turkish spatial discourse'. 9th International Conference on Turkish Linguistics. Oxford, August.
- Özyürek, A. 'Analysis of the use of Turkish demonstratives in natural conversation'. Orage '98: Conference on Speech and Gesture in Multi-modal Communication and Interaction. Besangen, December.
- Piepenbrock, R.J. 'The challenge of designing a multifunctional, easily accessible Dutch spoken corpus'. Workshop on Constructing and Accessing Multi-Media Corpora: Developments in and around the Netherlands. Nijmegen, February.

- Piepenbrock, R.J. 'A relational database architecture for lexica'. 1st International Conference on Language Resources and Evaluation. Granada, May.
- Roelofs, A. 'Shared phonological processes and representations in bilingual speakers'. Experimental Psychology Society (EPS) Workshop on 'Lexical Aspects of Language Production'. Exeter, September.
- Ruiter, J.P.A. de and Wilkins, D.P. 'The Synchronization of gesture and speech in Dutch and Arrernte (An Australian aboriginal language): A cross-cultural comparison'. Orage '98: Speech and Gesture in Multi-modal Communication and Interaction. Besangon, December.
- Senft, G. 'Frames of spatial reference in Kilivila - Studies in language, cognition, and the conceptualization of space. (Plenary Lecture). 26th International LAUD-Symposium: 'Humboldt and Whorf Revisited: Universals and Culture-Specific Conceptualizations in Grammar and Lexis'. Duisburg, April.
- Senft, G. 'The presentation of self in touristic encounters: A case study from the Trobriand Islands'. 6th International Pragmatics Conference. Reims, July.
- Senft, G. 'Aspects of spatial deixis in Kilivila'. Workshop on Spatial Deixis in Austronesian Languages. Nijmegen, November.
- Sereno, J. A. 'Some unexplored properties of lexical representation: Grammatical class effects'. Workshop on Lexical Representations in Language Comprehension. Konstanz, December.
- Smits, R. 'HICAT: A model for hierarchical categorization in phonetic perception'. 16th International Congress on Acoustics and 135th Meeting of the Acoustical Society of America. Seattle, June.
- Starren, M. and Broeder, D. 'Zijn corpora gebaseerd op tekst-files achterhaald?'. Workshop on Constructing and Accessing Multi-Media Corpora: Developments in and around the Netherlands. Nijmegen, February.
- Swift, M. D. Temporal reference in early Inuktitut'. 11th Inuit Studies Conference. Nuuk, (Greenland), September.
- Van Geenhoven, V. Time for children'. Workshop on Variation and Acquisition of Syntax and Semantics. Trieste, September.

- Van Geenhoven, V. 'On external possessors in West Greenlandic noun incorporating constructions'. Polysynthesis Workshop. Cologne, October.
- Van Geenhoven, V. 'A before-&-after picture of when-, before-, and after-clauses'. Workshop on Aspect and Achievements. Tübingen, November.
- Vonk, W. 'The perception of the thematic structure of the text and the role of linguistic discontinuity markers'. Symposium on Experimental Psycholinguistics and Functional-Cognitive Approaches to Sentence/Discourse Processing. Rungsted Kyst, (Denmark), February.
- Vonk, W. 'On-line sentence processing: Parsing preferences revealed by eye movements and ERPs'. 5th European Workshop on Language Comprehension. Luminy/Marseille, April.
- Vonk, W. 'Processes in discourse comprehension: The construction of a coherent text representation'. Reunion Conjointe du Groupe de Contact FNRS. Louvain-la-Neuve, November.
- Walsh Dickey, L. 'The processing of tone and pitch accent in Igbo and Japanese'. 72nd. Annual Meeting of the Linguistic Society of America. New York, January.
- Walsh Dickey, L. and Levinson, S.C. 'The phonetics of Rössel multiple articulations'. 72nd. Annual Meeting of Linguistic Society of America. New York, January.
- Wang, Y., Jongman, A. and Sereno, J.A. 'Training American listeners to perceive Mandarin tones: A first report'. 135th Meeting of the Acoustical Society of America. Seattle, June.
- Weber, A. 'Listening to nonnative language which violates native assimilation rules'. ESCA workshop: Sound Patterns of Spontaneous Speech. Aix-en-Provence, September.
- Weber, A. 'Help or hindrance: How violation of different assimilation rules affects spoken-language processing'. International Summer School on Neural Nets: Speech Processing, Recognition and Artificial Neural Networks. Vietri sul Mare, October.

- Wilkins, D.P. 'On the subClassification and semantics of motion verbs in Arrernte'. 3rd International Workshop on Australian Aboriginal Languages. Nijmegen, April.
- Wilkins, D.P. 'Learning 'put' and 'look' in Arrernte'. Cross-linguistic Perspectives on Argument Structure: Implications for Learnability. Nijmegen, June.
- Wittenburg, P., Brugman, H.G. and Broeder, D. 'Impacts of modern information technology on corpus-based research'. Computers in Psychology Conference 98. York, April.
- Wittenburg, P., Brugman, H.G., Broeder, D. and Rüssel, A. Towards scientific collaboration in a universe of distributed multi-media corpora'. BASLOW Workshop on Distributing and Accessing Linguistic Resources. Baslow, December.
- Wittenburg, P., Nagengast, J. and Baumann, H. 'NESU - the Nijmegen Experiment Setup'. Computers in Psychology Conference 98. York, April.
- Wittenburg, P., Rüssel, A. Brugman, H.G. and Broeder, D. 'Moderne Informationstechnologie und ihre Auswirkungen auf die korpusbasierte Forschung'. 28. Jahrestagung der Gesellschaft für Informatik. Magdeburg, September.
- Zavala, R. 'Inverse clauses with non-agentive bivalent verbs in Olutec (Mixe-Zoquean)'. Workshop on Cross-linguistic Perspectives on Argument Structure: Implications for Learnability. Nijmegen, June.
- Zavala, R. 'Incorporation versus conflation of cognate arguments in Olutec (Mixean)'. Problems of Polysynthesis. Cologne, October.

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- Allen, S.E.M. (1998). Categories within the verb category: Learning the causative in Inuktitut. *Linguistics*, 36 (4), 633-677.
- Ameka, F.K. (1998). Les particules enonciatives en Ewe. In S. Platiel & R. Kabore (eds.) *Les langues d' Afrique Subsaharienne* (pp. 179-204) Paris: Orphys.
- Baayen, R.H. (1998). Lexis, word frequencies, and text type. In M.T. Cabre (ed.) *Jornades de corpus linguistics 1996-1997* (pp. 87-102). Barcelona: Universitat Pompeu Fabra.
- Baayen, R.H. & Tweedie, F.J. (1998). Sample-size invariance of LNRE model parameters: Problems and opportunities. *Journal of Quantitative Linguistics*, 5 (3), 145-154.
- Baayen, R.H., Neijt, A. & Schreuder, R. (1998). Wat doet een n meer of minder ertoe? De spelling van de tussen-n en het leesproces. *Onze Taal*, 3,131-136.
- Behnke, K (1998) The acquisition of phonetic categories in young infants: A self-organising artificial neural network approach. Doctoral Dissertation: MPI Series in Psycholinguistics 5.
- Bierwisch, M. (1998). Wissenschaften im Vereinigungsprozeß. Versuch einer Bilanz. Interdisziplinäre Arbeitsgruppen, *Forschungsberichte*. Hrsg. Berlin-Brandenburgische Akademie der Wissenschaften, Akademie Verlag, 6,485-507.
- Boettner, M. (1998). A collective extension of relational grammar. *Journal of the Interest Group of Pure and Applied Logics*, 6 (2), 175-193.

- Bohnenmeyer, J. (1998). Die Stellung sententialer Topics im Yukatekischen. In D. Zaefferer (ed.) *Deskriptive Grammatik und allgemeiner Sprachvergleich* (pp. 55-85). Tübingen: Narr.
- Bohnenmeyer, J. (1998). Temporal reference from a radical pragmatics perspective. Why Yucatec does not need to express 'after' and 'before'. *Cognitive Linguistics*, 9 (3), 239-282.
- Bohnenmeyer, J. (1998). Temporale Relatoren im hispano-yukatekischen Sprachkontakt. In A. Koechert & T. Stolz (eds.) *Convergencia e Individualidad. Las lenguas Mayas entre hispanización e indigenismo* (pp. 195-241). Hannover: Verlag für Ethnologie.
- Bohnenmeyer, J. (1998). Time relations in discourse. Evidence from a comparative approach to Yukatek Maya. Doctoral Dissertation. Katholieke Universiteit Brabant, Tilburg.
- Brown, P. (1998). Children's first verbs in Tzeltal: Evidence for an early verb category. *Linguistics*, 36 (4), 713-753.
- Brown, P. (1998). Early Tzeltal verbs: Argument structure and argument representation. In E. V. Clark (ed.) *Proceedings of the 29th Stanford Child Language Research Forum* (pp. 129-140). Stanford: CSLI.
- Brown, P. (1998). La identificación de las raíces verbales en Tzeltal (Maya): Como lo hacen los niños? *Function*, 17-18, 121-146.
- Brown, P. & Levinson, S.C. (1998). Politeness. Introduction to the reissue: A review of recent work. In A. Kasher (ed.) *Pragmatics: Critical concepts* (pp. 488-554). London: Routledge.
- Clark, E.V. (1998). Acquisition of morphology. In A.M. Zwicky & A. J. Spencer (eds.) *Handbook of Morphology* (pp. 374-389). Oxford: Blackwell.
- Clark, E.V. (1998). Constructions and conversation: A comment on Tomasello's review essay. *Journal of Child Language*, 25, 471-474.
- Clark, E.V. (1998). Lexical creativity in French-speaking children. *Cahier de Psychologie/Current Psychology of Cognition*, 17, 513-530.
- Clark, E.V. (1998). Lexique et syntaxe dans l'acquisition de langage. *Langue Française*, 118, 49-60.

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- Cutler, A. (1998). The recognition of spoken words with variable representation. *Proceedings of the ESCA Workshop on Sound Patterns of Spontaneous Speech*. Aix-en-Provence, (pp. 83-92).
- Cutler, A. & Otake, T. (1998). Assimilation of place in Japanese and Dutch. In R.H. Manned & J. Robert-Ribes (eds.) *Proceedings of the 5th International Conference on Spoken Language Processing* (pp. 1751-1754). Sydney: Australian Speech Science and Technology Association.
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