Max-Planck-Institut für Psycholinguistik

ANNUAL REPORT 15
1994

Editors: Eric Pederson and Ardi Roelofs
With assistance from Sylvia Aal

Wundtlaan 1, 6525 XD Nijmegen, The Netherlands
Telephone: 080-521911 (International: 3180-521911)
(After October 1995: 024-3521911)
Telefax: 080-521213 e-mail: @mpi.nl
(After October 1995 024-3521213)
ISSN 1380295X

Table of Contents

Preface iii

Organization of the Institute and the Cognitive Anthropology Research Group in 1994 v

Project Descriptions

1. Phonological Structure in Comprehension 3
2. Spoken Word Recognition 15
3. Lexical Access in Speech Production 27
4. Argument Structure 39
5. Change of State 51
6. Space 65
7. Gesture 89
8. Sentence and Discourse Integration 93
9. Neurocognition of Language Processing 105
10. Structure of Learner Varieties 117
11. Research Group on Structural Grammar 125
12. Other Research 133

Other Activities 143

Publications 169

Index of Names 181

Preface

Last year the Institute was able to consolidate its new structure. Its permanent base will now consist of four Research Units dedicated, respectively, to the study of language comprehension, language production, language acquisition and the relations between language and thought. Dr. Stephen Levinson, the leader of this latter Unit (currently realized as the Cognitive Anthropology Research Group), was appointed in 1994 as the Institute's fourth scientific director. This development further adds to the Institute's cross-linguistic perspective in the study of language and mind.

The four Units jointly organize their research in the framework of ten mid- to long-term Institute Projects. During the last year these Projects gained so much momentum that we decided to organize the present Annual Report in terms of the Projects rather than in terms of the Units. In addition, the present report reviews the work of Manfred Bierwisch's Max Planck Research Group on Structural Grammar at the Humboldt University in Berlin. In the following pages asterisks are used to mark names and publications from this Group.

Finally, part of the Institute's research is not (yet) organized in Institute Projects. This work is covered in a separate section "Other research".

Among the many personnel changes that took place during 1994 two deserve special mention. Dr. Veronika Ehrich accepted a professorship at the University of Tübingen and Dr. Jürgen Weissenborn accepted a professorship at the University of Potsdam. Both had been with us since the founding years of the Institute. We wish them good luck in their new academic environments.

Willem Levelt

Organization of the Institute and the Cognitive Anthropology Research Group in 1994

Scientific council:

D. Slobin, chair
K. Bock
P. Kay
J. Korf
E. Lang
J. Miller
D. Ploog
J. Raaijmakers
J. Schumann
H. Wässle

Directors:

A. Cutler
W. Klein
W. Levelt, managing director
S. Levinson

External scientific member and head of the Research Group on Structural Grammar (members indicated with a *):

*M. Bierwisch

Scientific research staff:

S. Allen
H. Baayen
H. Behrens
*R. Blutner
A. Bolwiender
M. Bowerman
C. Brown
P. Brown
D. Chwilla-Derix
R. Coolen
E. Danziger
G. Desserjer
W. van Donselaar
*J. Dölling
K. Drozd
V. Ehrich
G. Flores d' Arcais
J. Groothusen
P. Hagoort
A. Haveman

C. Heeschen
H. Hendriks
D. Hill
A. van Hout
P. Indefrey
M. ter Keurs
S. Kita
C. Kuijpers
B. Löbach
J. McQueen
A. Meyer
L. Nagy
E. Pederson
*M. Reis
K. Remmerswaal
A. Roelofs
F. Roland
G. Senft
*A. Strigin
T. Swaab
W. Vonk
M. Wassenaar
J. Weissenborn
*C. Wilder
D. Wilkins

Research Associates:

H. Günther	U. München
P. Jordens	F.U. Amsterdam
A. Kelly	U. Heidelberg

Visiting Research Fellows:

G. Altmann	U. Sussex, Brighton
K. Bock	U. Illinois, Champaign, USA
M. Böttner	Stanford U.
J. Boland	Ohio U., Columbus
J. Boster	U. California, Irvine
C. Burani	Instituto di Psicologia, Roma
H. Chen	The Chinese U., Hong Kong
S. Choi	San Diego State U.
J. Christiansen	Boston VA Medical Center
C. Connine	State U. New York, Binghamton
E. Drews	T.U. Braunschweig
U. Frauenfelder	U. Geneva, Carouge
L. Frazier	U. Massachusetts, Amherst
S. Gaskins	U. Pennsylvania, Philadephia
J. Haviland	Reed College, Portland, Oregon

K. Inoue	College of Letters, Colorado Springs
L. de León	Reed College, Portland, Oregon
P. Levy	Universidad Nacional Autonoma de Mexico
P. van Lieshout	U. Nijmegen
J. Lucy	U. Pennsylvania, Philadephia
D. Norris	MRC Applied Psychology Unit, Cambridge, United Kingdom
L. Osterhout	U. Washington, Seattle
*J. Ouhalla	U. London
C. Perdue	U. Paris VIII
M. Potter	MIT, Cambridge, USA
*J. Pustejovsky	Brandeis U.
R. Radach	RWTH, Aachen
A. Ramat	U. Pavia, Italy
J. Randall	Northeastern U., Boston
P. Roach	U. Leeds
T. Roeper	U. Massachusetts, Amherst
H. Saito	Nagoya U., Japan
P. Seuren	U. Nijmegen
D. Slobin	U. California, Berkeley
A. Sorace	U. Edinburgh
R. Sproat	AT & T, Bell Laboratories, Murray Hill
H. Schriefers	U. Nijmegen
A. von Stechow	U. Tübingen
C. von Stutterheim	U. Heidelberg
R. van Valin Jr.	State U. New York, Buffalo
S. Weinert	U. Bielefeld
L. Wheeldon	U. Birmingham
P. Zwitserlood	U. Münster

Ph.D. Students:

M. Baumann	*A. Demjjanow
K. Behnke	*H. Gärtner
G. Bennardo	E. Grabe
J. van Berkum	A. Haveman
B. Bickel	*G. Jäger
J. Bölte	M. Koster

I. Lasser
P.Meijer
R.F. Min
S. Neumann
R. Nüse
J.P. de Ruiter
N. Schiller
B. Schmitt
*M. Starke
M. Starren
S. Stoll
C. Stolz
M. van Turennout
J. van de Weijer
T. Widlok

Technical Staff:

P. Wittenburg, head
S. Aal
H. Baumann
D. van den Born
D. Broeder
H. Brugman
R. de Bruin (NWO)
R. Dirksmeyer
I. Doehring
H. Drexler
L. Gulikers
C. Hausmann-Jamin
J. Jansen
G. Klaas
J. Nagengast
R. Piepenbrock
*M. Schitting
C. van der Veer
A. Verbunt
H. van Viersen
J. Weustink

Administration and Other Services:

R. Koenig, head
C. Bergacker
*B. Bülow
J. Gerrits
G. de Groen
*H. Klug
A. Janssen
P. Janssen
U. Maier
H. Müller
N. Nielen
P. van Rijswijk
P. Verleg

Library:

L. van Dreumel
K. Kastens
J. Sprooten
*E. Thalheim

Secretaries:

*R. Eickhoff
M. Jonas
M. Raad
U. de Pagter
E. Sjoerdsma

Project Descriptions

1. Phonological Structure in Comprehension

This project investigates the ways in which the processing of spoken and written language input is constrained by the phonological structure of the input language. Research on this project in 1994 ranged from the investigation and modeling of infants' acquisition of native phonology, through studies of the role of phonological structure in written and spoken word recognition by monolinguals, to cross-linguistic studies of speech processing.

1.1 Acquisition of phonological structure

1.1.1 Syllable frequency in infants' speech segmentation

Earlier work of A. Friederici and J. Wessels on infants' speech segmentation (see Annual Reports 1990-1993) established that 9-month old infants distinguish legal from illegal onset and offset clusters in monosyllabic pseudowords. Infants prefer legal over illegal clusters, both in isolated and contextually embedded pseudowords. R. Coolen and W. Levelt (project supported by the Human Capital and Mobility Program of the European Community) extended this work by examining the role of syllable frequency. Friederici and Wessels' legal pseudowords contained syllables with higher frequency of occurrence in the Dutch language than their illegal pseudowords. In order to test for effects of syllable frequency, pairs of high and low frequency syllables (CCVC) were selected that only differed in the last phoneme (e.g., /blin/ versus /blit/). 9-month old infants indeed listened longer to the high frequency syllable lists than to the low frequency lists. Post-hoc analyses of the stimulus materials, however, showed that syllable frequency was confounded with the transitional probabilities of the phonemes within the syllables. Therefore, a second experiment in progress examines high and low frequency syllables matched for phoneme-to-phoneme transitional probability and positional phoneme probability.

1.1.2 Infants' detection of words in fluent speech

Cross-linguistic studies of infants' detection of words in connected speech by Coolen, C. Kuijpers and A. Cutler in collaboration with P. Jusczyk (SUNY Buffalo) are in progress, addressing in particular the role of stress patterns in recognizing bisyllabic words in Dutch and English. Infants of 7 1/2 months of age are familiarized with a particular bisyllabic word having either a strong/weak stress pattern (e.g., *dokter*) or a weak/strong stress pattern (e.g., *beton*). These bisyllabic words are repeated several times in isolation. Then, during a later test phase, infants' responses are assessed to passages containing a partial match of the previously presented bisyllabic word involving only the strong syllable of this item (e.g., *dok* or *ton*). Listening times to passages including the 'familiar' strong syllable are compared to passages without the 'familiar' strong syllable.

1.1.3 Modeling of phoneme acquisition

The ambient language influences the discriminative capabilities of infants even during the first year of life. The infants' decrease in discrimination is modeled in the dissertation work of K. Behnke (see Annual Report 1993) in terms of the development of phonetic categories as memory representations of the distributional properties of the language the infants are exposed to. The model has been implemented in a neural network in which units are arranged in a two-dimensional map. At the beginning of a simulation, the individual weight-vectors are randomly distributed in the input space; based on the received input vectors and the underlying adaptation rule, clusters of units with similar weight-vectors develop within the map. The clusters describe a mapping of the categories in the input space. First simulations with artificial input (categories described by specified regions within the two-dimensional input space) showed that only those clusters of units developed and survived which represented one of the pre-defined input areas. Other randomly developed clusters decreased in size and eventually disappeared. Further simulations with real speech input are planned.

1.1.4 Speech input to a prelinguistic infant

By the end of the first year of life, an infant has acquired the beginnings of a vocabulary, both passive and active. But how do

infants begin the process of vocabulary acquisition? For instance, are there ways in which the speech input received by infants specifically encourages the extraction of potential vocabulary items? Although a good deal of research has been conducted on the characteristics of speech addressed to young children, most of this research has involved children above the age of one year, i.e., children who already possess a rudimentary vocabulary and are engaged in the work of expanding it. Work on the prosodic characteristics of speech to infants, in contrast, has chiefly involved infants in the first few months of life. The crucial period for solving the problem of what words are like in the input language would seem to lie between six months (at which infants do not distinguish probable from improbable words of the language) and nine months (by which they can make this distinction). A. Meyer has recorded all the input to an infant between the ages of six and nine months. The infant was awake for approximately nine hours per day; of this wakeful time more than 90% was successfully recorded. The recorded speech (on more than 800 hours of tape) is currently being classified as to source and addressee (e.g., adult-to-adult; adult-to-infant; etc.) in the dissertation work of J. van de Weijer. Further steps in the project will involve extensive acoustic analyses.

1.2 Phonology in word recognition

1.2.1 Processing of lexical tone

Investigations of the perception of lexical tone in Cantonese by H. Chen (Chinese U. of Hong Kong) and Cutler revealed that the contribution of tonal information to lexical identity is analogous to that of segmental information, but that the processing of tonal information is relatively slow (thus a tone is apparently identified later than the vowel which carries it). Evidence motivating the conclusion that tone perception is relatively slow emerged from listeners' same-different judgements for pairs of CV syllables: Response times to decide that two syllables were different were fastest if the syllables differed in consonantal onset, slower if they differed in the vowel, and slowest if they differed in tone. Similarly, auditory lexical decisions to bisyllables differing from real words only in the onset, vowel or tone of the second syllable were least prone to error when the onset differed, more errorful when the vowel differed, and most errorful when the tone differed.

The conclusion that tone contributes to word identification in

a manner analogous to segmental information arose from further investigations of phonological similarity effects. Previously, such studies have reported mixed results: Some have reported inhibitory effects of previously heard words overlapping with the beginning of a response word, others have failed to find inter-word effects. Virtually all work on this topic has been conducted in European languages, however. Two experiments were conducted in which subjects decided whether or not the second of a pair of two spoken items was a real word of Cantonese. Of the real-word targets, one quarter were preceded by a phonologically and semantically unrelated word (a baseline control condition). A further quarter were preceded by a semantically but not phonologically related word (a further control condition to establish that the conditions for inter-word effects had been met). The remaining items were preceded by a phonologically related (but semantically unrelated) word. In all of these the two spoken items (prime and target) shared one syllable but differed in either the tone or the rime of a second syllable. In Experiment 1, the prime and target shared the initial syllable and differed in the second syllable (e.g., /ji6liu4/ "treatment" - /ji6liu5/ "feed"; /to4fa1/ "peach flower" - /to4foo1/ "butcher"). In Experiment 2, they shared the second syllable and differed in the initial syllable (/to4wa6/ "picture" - /to2wa6/ "dialect"; /si6yip6/ "career" - /sue6yip6/ "leaf"). In all cases, the overlapping syllables were morphologically different. Experiment 1 showed slower responses in both phonological overlap conditions. Thus, recognition of a spoken Cantonese word may be inhibited by having just heard another word beginning in the same way. This is consistent with reported results from European languages, and is accountable in terms of competition-based models of spoken-word recognition. In Experiment 2, however, responses were faster in both phonological overlap conditions. Thus, recognition of a spoken Cantonese word appears to be facilitated by having just heard another word ending in the same way. This differs from results reported for English, but may be interpreted in terms of a language-specific syllabic level of representation in Cantonese (but not English) word recognition. In both experiments, alterations of rime and of tone between prime and target had exactly parallel effects, implying that the contribution of tonal information to auditory word recognition is analogous to that of segmental information.

1.2.2 Phonological processes in recognizing Chinese characters

Earlier work by G. Flores d'Arcais and Chen (Annual Report, 1993) showed clear effects of visual similarity (but no phonological effects) in a Chinese semantic categorization task. During 1994, two additional experiments were carried out using a priming procedure with a character naming task, with appropriate manipulation of the relation between a prime and a target (graphically similar, homophonic, or unrelated). The exposure duration for the primes was fixed to provide sufficient time for prime identification and to prevent possible conscious use of some form of phonological coding. If the phonological form of a character (in this case a homophonic prime) is automatically activated when the character is shown, then the identification of the immediately following target character should be facilitated (e.g., by activating the target's name before identification or by making its name more available to production). However, no phonological priming was found in either experiment. Rather, the results showed reliable effects of graphic priming on the time to name the target character in both experiments. These results are compatible with the previous result, and do not support the notion of automatic phonological activation as a universal principle of visual lexical processing.

1.2.3 Radical migration in the recognition of Japanese kanji characters

The Annual Reports of the last two years reported research on radical migration in the recognition of kanji characters by Flores d'Arcais together with H. Saito (Nagoya U.). A pair of "source" characters was presented very briefly (e.g., 40 msec), followed by a mask and by a probe character. In the critical condition, this probe character contained two of the radicals (or main components), one from each of the characters of the source pair. Subjects often report that the probe has been one of the previously presented characters. For example, the left radical of the left source character and the right radical of the right source character may migrate perceptually and blend in the character reported by the subject. An interesting asymmetry emerged in the form of a higher likelihood of migration of the right radical. In the large majority of Chinese characters, and for all characters tested, the right radical conveys information about pronunciation. Thus, the result was explained in terms of earlier activation of the phonological information associated with the right radicals. The existence of a strong homophone

effect, which was the result of a second study – when the probe character is homophonous with one of the source characters, radical migration is more likely to take place – is not inconsistent with the latter results about a higher migration proneness of the right, phonetic radical. If the right radical is processed more easily, then phonological information would be more readily available and affect the migration responses.

These results have been replicated in a number of new experiments carried out in 1994. There were two additional findings. Saito and his co-workers compiled a count of the number of different right and left radical types in a corpus which included a large number of the most frequently used complex characters, and found that right radical types are three times more numerous than left radicals. The two radicals clearly differ in terms of the degree of informativeness for character identification. Identification of the left radical is much less useful than right radical identification for recognition of most characters. Thus, earlier processing of the right radical is ecologically more convenient that earlier processing of the left radical. This evidence offers an alternative explanation for the ease of migration of the right radical. Another experiment investigated whether the homophonic effect previously found and briefly summarized above could have been explained purely in terms of phonological similarity: The reader notices some phonological similarity between source characters and probe, and decides that the probe has been one of the source characters. In this way, radical migration would be due to response bias, not to a perceptual effect. Source-probe pairs were presented with no figural similarity (no radical in common between source and probe) but with homophony between source and probe. Homophony between probe character and one of the source characters was effective only in presence of a figural similarity source-probe: Homophony alone yielded no effect, thus indicating that the phonological effect found earlier was a genuine effect on radical migration, not a generic perceptual bias effect.

1.2.4 Orthographic knowledge in reading and writing of Japanese names

The relation between orthographic knowledge and the principles underlying the choice of characters in writing Japanese are the subject of a new investigation by Flores d'Arcais together with G. Hatano and

S. Takimoto (both Dokkyo U.). Every reader of Japanese has orthographic knowledge which guides the choice of the appropriate characters for the words they have to write. This knowledge probably includes (a) a large number of specific lexically related units, learned by rote; (b) a number of more general orthophonotactic elements (such as the specific pronunciation of a radical); (c) a number of principles guiding combination of radicals etc.; (d) a number of principles guiding the order of stroke writing, and (e) some principles guiding the choice of one or another character to write new complex words, or words indicating localities, places, personal names, etc. For the skilled reader, this knowledge is constantly used in writing, including the writing of new words, for which the writer does not know the appropriate character, or has to take decisions about alternative choices of kanji which in principle are all adequate to represent a given word, as with names of locality and personal names. Names are a particularly interesting object of investigation. For names such as those of the subway and railway stations in the Greater Tokyo area there is, at least in principle, a choice of different characters. Given a CVCVCVCV word, for example, and the availability of a number of alternative kanji, one can, in principle, write CV CVCV CV, or alternatively CVCV CVCV, or, possibly, CV CV CV CV, etc. Of course, all written forms of these names could be learned by rote; but people can easily read, and also write, names of places which they have not encountered before. It is thus likely that there are a number of principles guiding the choice of kanji used to write these words.

Two alternative hypotheses were proposed. According to the first, the listener parses the word in some form, choosing a given segmentation on the basis of phonological and morphological principles, and once the segmentation is made by the word parser, the choice is, to some extent, constrained. The writer has now only to select, among the available kanji which correspond in the lexicon to the segment isolated, an appropriate one. The second hypothesis proposes that segmentation is, in part or totally, constrained by the selection of some kanji, based either on semantic/lexical principles (this place "means" something) or on lexical/sublexical principles such as frequency, well formedness, etc. (e.g., this part of the word is very frequently used for locality names, or it indicates a geographical direction, or is a "well formed" part of the word). The two hypotheses correspond to two alternative procedures for arriving at the writing of

a new word, namely a segmentation first and a lexicon first procedure. According to the first, segmentation is made first on the basis of phonological principles, and the selection of the kanji is made after. According to the second, the choice of appropriate kanji on the basis, essentially, of lexical knowledge determines segmentation. In the work carried out so far, subjects were given non-existent names of places and asked to write them down. In another experiment, they were requested to evaluate which of alternative writings was the most appropriate for the word. The results to date suggest that there are preferred segmentation principles governing the choice of the writing, but that these are used in combination with lexical principles.

1.2.5 Phonological cues to word class

The vocabulary of languages like Dutch and English can be divided into open class (e.g., nouns, adjectives) and closed class item sets (e.g., articles, pronouns). Systematic phonological differences between these classes exist in both languages; words of the closed, but not of the open, class may contain only reduced vowels. Possible inter-class differences in access, storage, and post-access processes are investigated in the dissertation research of A. Haveman. An auditory repetition experiment did not show differences in speed of access between open and closed class items matched for frequency of occurrence. However, a significant difference between these high frequency open and closed class item sets appeared when they were used in an auditory lexical decision task: Decisions were faster on open class items than on closed class items. When the high frequency closed class items were further compared with a set of low frequency open class words (with less well established meaning), however, the difference disappeared. This result suggests that the difference arises at a post-access semantic level rather than at an access level.

In the next two experiments, open and closed class items were studied in minimal context. A word-spotting task was used to investigate whether listeners make use of the systematic differences in phonological realization between open and closed class items. In the first experiment, subjects were instructed to detect stressed and unstressed open and closed class items in auditory presented nonwords (e.g., *domfuul* - *hemfuul*). Results showed that stressed open class words were detected faster than unstressed open class words, irrespective of their frequency. For closed class items, the influence of

stress was found to be different for low versus high frequency items: Whereas low frequency items were recognized faster in their unstressed variant, the recognition of high frequency items was not influenced by stress. This difference between the two classes is consistent with a processing difference at a pre-access level. A second word-spotting experiment showed that subjects do not accept either open or closed class items with reduced vowels (e.g. *fuuldəm - fuuləm*) as being real words, when these items are not presented in a sentence context.

1.3 Cross-linguistic studies of speech processing

1.3.1 Lexical stress

A new dissertation project by M. Koster concerns speech processing by Dutch/Spanish monolinguals and bilinguals, focussing on the role of lexical stress, vowel repertoire and vowel reduction in the comprehension of these two languages. Dutch and Spanish differ crucially in these aspects of phonological structure. Dutch is a language with various and complex syllable structures and often opaque syllable boundaries. It has a large vowel repertoire of 16 vowels. In Dutch, stress is variable and it is partly related to vowel reduction. In contrast, Spanish is a language with mostly simple (CV) syllables and clear syllable boundaries. Stress is variable, but not coupled to vowel reduction, because unstressed vowels are not (or hardly ever) reduced.

In a first experiment the effect of stress and vowel quality was investigated in a perception task with mispronounced Dutch words. Subjects were presented with a visual word, followed by an auditory target, which could be mispronounced by a change in vowel quality and/or lexical stress (e.g., *koNING* for *KOning*, or *BEEdrag* for *beDRAG*, etc.). Subjects judged whether the visual and auditory word were similar in meaning or not. This task thus required subjects to recognize the auditory word, despite possible mispronunciations. Initial results suggested that both misplacement of stress and misassignment of vowel quality had independent adverse effects on the recognition of the spoken words.

1.3.2 Vowel epenthesis

In Dutch, epenthesis, or insertion, of the vowel schwa frequently occurs between liquids and non-coronals in monosyllabic words (for instance,

melk 'milk' pronounced as [mɛləkʲ]). Schwa epenthesis is not restricted to tautosyllabic clusters, as its further occurrences in bisyllabic words show (e.g., *melken* 'to milk' pronounced as [mɛləkən]). As schwa epenthesis occurs very frequently, but not fully consistently in Dutch, it is not clear how realizations with and without intrusive schwa are phonologically represented and processed. A new project (W. van Donselaar, Kuijpers, Cutler) aims to investigate whether realizations like [mɛlk] and [mɛləkʲ] have different underlying phonological representations. Words with and without intrusive schwa will be tested in experiments via syllable monitoring and implicit priming tasks.

The status of schwa epenthesis in Dutch contrasts with the apparently similar phenomenon of reduced-vowel epenthesis in Japanese, which serves inter alia to impose Japanese phonological constraints upon foreign words involving consonant clusters which do not occur in Japanese (for example, English *express* becomes *e-ki-su-pa-re-su*). Epenthesis in Japanese is both frequent and fully consistent. The Dutch experiments are to be followed by comparable experiments in Japanese in collaboration with T. Otake (Dokkyo U.).

1.3.3 Nasal consonants and syllable structure

Studies of the detection of phoneme targets by Japanese listeners (Cutler, in collaboration with Otake) showed that moraic consonants and vowels are detected faster than non-moraic; thus /n/ was detected faster in *kanko* than in *kanojo*, and /o/ was detected faster in *aoki* than in *tokage*. Japanese listeners showed this effect both in their own language, and, in the case of nasal consonant targets, with English materials: /n/ was detected faster in *candy* than in *canopy*. English listeners, in contrast, showed no effects of moraic structure on phoneme detection time; thus the finding was interpreted as further evidence of the (language-specific) importance of moraic structure for speech segmentation in Japanese.

The moraic nasal consonants occur in syllable coda position and their phonetic realization is affected by homorganic assimilation to following context. Thus in words like *tombo* the moraic nasal is realised as the bilabial [m] before the bilabial obstruent [b], in *ringgo* it is velar before [g], in *kinri* it is palatal before [r] and in *kondo* it is alveolar before [d]. Words with all four of these phonetic realizations were used as targets in a further phoneme detection experiment, in

which subjects were instructed to detect a sound which could be represented with the roman character N. Responses were equally fast and accurate irrespective of effects of phonetic context (and were always faster than responses to non-moraic nasals). In contrast, Dutch listeners presented with the same materials showed clear effects of the phonetic realization; the nasal in *tombo* was responded to given an instruction to detect /m/ but not given an instruction to detect /n/, while the reverse was true of, for example, the nasal in *kondo*. The results suggest that Japanese listeners' processing advantage for moraic targets involves a more abstract level of representation than the phonetic. Further studies in progress are testing this hypothesis via cross-splicing of moraic nasals between phonetic contexts.

2. Spoken Word Recognition

Work on this project consisted of three interconnected strands of research: experimental work; statistical analysis of spoken language; and computational modeling. Experiments focused on phonotactic and lexical effects in phonetic categorization and on the representation of morphologically complex words. The statistical analyses have examined the proportion of words embedded in other words in continuous speech. Computational work has been carried out on morphology and on the development of connectionist models of speech recognition.

2.1 Phonotactic and lexical effects

J. McQueen and A. Cutler, in collaboration with D. Norris (MRC Applied Psychology Unit, Cambridge), have been examining listeners' use of phonotactic and lexical knowledge in the categorization of speech sounds in English words and nonwords. Every item which subjects heard contained a /t/, a /k/, or /?/ a phoneme ambiguous between /t/ and /k/. For each item, subjects had to decide whether it contained a /t/ or a /k/. Powerful phonotactic effects were observed. Subjects labeled the ambiguous phoneme almost always as /k/ when /t/ was phonotactically illegal (in a triplet such as *tlig-?lig-klig*), but performance was close to chance on /?/ when both alternatives were legal (in a triplet such as *trabe-?rabe-krabe*). Subjects even labeled the unambiguous /t/ more often as /k/ than as /t/ when /t/ was illegal. Strong lexical effects were also observed. Subjects labeled /?/ as /t/ more often in e.g. *trace-?race-krace* (where only the /t/ endpoint was a real word) than in e.g. *trave-?rave-crave* (where only the /k/ endpoint was a real word); that is, they tended to make lexically-consistent responses.

Targets were also presented in final position. Although both types of effect were weaker than for the initial targets, both phonotactic and lexical effects were again found. Subjects labeled final /?/ as /t/ more often in triplets such as *pift-pif?-pifk* (where /k/ is now phonotactically illegal) than in e.g. *nist-nis?-nisk* (where both alternatives are legal), and they labeled /?/ as /t/ more often when only the /t/ endpoint was a real word (*list-lis?-lisk*) than when only the /k/

endpoint was a real word (*dist-dis?-disk*).

The aim of this experiment was to test if these effects come and go together (as predicted by interactive models of spoken word recognition, like TRACE, which attributes both effects to the same mechanism of top-down facilitation), or if they disassociate (as predicted by the autonomous Shortlist model, which attributes the effects to two separate mechanisms). Attentional focus on lexical information (which has been repeatedly shown to influence the size of lexical effects) was therefore also manipulated. In one version of the experiment, lexical information was highlighted, in that most of the fillers were real words. In the other version, lexical information was not highlighted: Most of the items were nonwords. If the effects disassociated, phonotactic effects should have appeared in both versions, but lexical effects only in the lexically-biased version; if the effects came and went together, both effects should have appeared in the lexically-biased version, and neither in the other version. Unfortunately, both effects appeared in both versions. Follow-up experiments are being planned where the lexical bias manipulation will be strengthened.

2.2 Morphological representation

McQueen, H. Baayen and R. Schreuder (U. Nijmegen) have explored the representation of morphological knowledge in the mental lexicon, looking specifically at derivational prefixes in Dutch. They employed a cross-modal priming paradigm, where auditory words were followed immediately by visual words and nonwords, to which subjects made lexical decisions. Decision times were measured for target words which were preceded either by morphologically related primes or control words. It was hypothesized that faster lexical decisions to primed targets would only be found for certain morphological relationships. No priming was predicted when primes and targets were semantically opaque. This prediction was confirmed. Lexical decisions were no faster to e.g., *ontwerpen* 'to design' when preceded by *werpen* 'to throw' than in the control condition. Similarly, *ontwerpen* failed to prime either *werpen* or *verwerpen* 'to reject'. It appears that only transparent morphological relationships are represented in the mental lexicon.

Word pairs which were semantically transparent were also tested. Some pairs were fully transparent, where the prefixed form's

meaning was simply a combination of the meanings of the prefix and the stem (for example, the meaning of *ontkoppelen*, 'to uncouple', is clear from the combination of the prefix *ont-* and the stem *koppelen*, 'to couple'). Priming was predicted for these words, since they should all be recognized via contact with the same lexical representation. Decisions were indeed faster on e.g. *koppelen* after *ontkoppelen* and on *ontkoppelen* after *koppelen*. No reliable priming, however, was found between e.g. *ontkoppelen* and another fully transparent prefixed form like *herkoppelen* 'to recouple', but this may have been because many of the targets in this condition were of very low frequency. A further experiment is being planned to test higher frequency pairs.

Finally, semi-transparent words were tested. These were items where there were clear semantic links between stems and prefixed forms, but where the meaning of the prefixed forms went beyond what could be derived from the combination of prefix and stem meanings. For example, the meaning of *herdenken* 'to commemorate' goes beyond the combinatorial meaning, where *her-* (like English *re-*) plus *denken* 'to think' would literally mean to re-think. Asymmetric priming was predicted, and found, for these words. Decisions were faster to e.g., *denken* after *herdenken*, but there was no priming for *herdenken* after *denken* or for *verdenken* 'to suspect' after *herdenken*. These results support the view that semi-transparent morphological families should have independent but linked lexical representations, such that access of a prefixed form activates its stem, but neither stems nor other prefixed forms should activate prefixed forms.

2.3 Issues in access and selection

J. Bölte (U. Münster) continued his investigation of the role of mismatching and matching information in access and selection in spoken word recognition. It has been proposed that the activation level of representations depends on the amount of overlap with the acoustic-phonetic input. COHORT assumes that a deviation not larger than a single feature leads to a deactivation of mismatching lexical units. TRACE, on the other hand, presents an approach in which the activation of lexical units is modulated by the degree of overlap between the input and the lexical representation. Mismatching information does not lead to deactivation or inhibition but only to less

activation.

Bölte constructed a set of four pseudoword primes which differed from a real word in the position of the deviating phoneme and the number of deviating phonemic features (e.g., from *anekdote*, 'anecdote' - *amekdote*, *apekdote*, *anekdode*, and *anekdoze*). He obtained a facilitatory priming effect in a cross-modal form priming experiment with lexical decision. In contrast to his previous work, the size of the priming effect covaried with the degree of phonological overlap between prime and target (a phonological distance effect). If the deviation was at stimulus onset, more overlap resulted in more priming. For deviations at offset the effect was reversed. This result is problematic for both TRACE and COHORT.

The same set of materials was also used in a cross-modal form priming experiment with color naming. The subjects had to name the color of the target stimulus. Phonological overlap resulted in an inhibition effect. The degree of phonological overlap did not influence the size of the inhibition effect. The disappearance of the phonological distance effect could be due to the overall reduced size of the effect as well as to slower reaction times.

U. Frauenfelder (U. Geneva) analyzed how psycholinguistic models of spoken word recognition have evolved from simply being verbal to being computer-implemented. Four major models (Cohort I, Cohort II, Trace and Shortlist) that exemplify this evolution were examined and evaluated in terms of how well they account for the available experimental data. Frauenfelder investigated the way in which their assumptions about the nature and direction of activation flow led to divergent predictions concerning sublexical processing, lexical activation, lexical selection, and the time-course of recognition. Particularly interesting were the models' divergent predictions concerning the activation of embedded words as a function of their position and of the lexical status (word vs. nonword) of the carrier items. Also important were the differential effects predicted for phonological mismatch as a function of the lexical status of the sensory input. Further experimental exploration of these issues in progress should help narrow down the immense space of theoretical possibilities.

During her stay at the Institute, J. Boland (U. Ohio), together with Cutler, wrote a paper comparing models of word recognition with

models of syntactic parsing. They studied psycholinguistic models in which multiple outputs are generated from a given level of processing, followed by selection between these outputs using information from higher levels of processing. Word recognition models of this type are considered to be autonomous, while parsing models with the same architecture are considered to be interactive: Boland and Cutler argued that the inconsistency is not due to fundamental differences between lexical and syntactic processing, but rather arose from attempts to achieve maximal contrast between new models and the model or models currently dominating the respective fields.

2.4 Lexical statistics

The efficiency of spoken word recognition depends upon, among other factors, the pattern of occurrence of words within other words. If within-word embedding in spoken words, such as *can* and *canned* in *candle*, occurs to a considerable degree, it could give rise to problems for the on-line recognition of continuous speech.

To ascertain the extent to which embedded words occur, Cutler, McQueen, H. Drexler and Baayen, together with P. Roach (U. Reading), constructed a dictionary of all the words (7304 word types) occurring in MARSEC, the machine-readable version of the Spoken English Corpus, which contains 49269 word tokens of spoken British English. They searched this dictionary for within-word occurrences of all English words listed in the CELEX lexical database. Their analyses revealed that within-word embedding is ubiquitous. For instance, in a phoneme-based analysis, only 7.7% of the word tokens in MARSEC contained no embedded words, 40.3% contained one embedded word, and 52% contained more than one embedded word. Moreover, within-word embeddings were found to occur primarily at word onset. By allowing syllable information to reduce the extent of embedding, which amounts to excluding *cant* as an embedded word in *can$ter*, the frequency of embedding is reduced but by no means eliminated, and word-initial embedding remains predominant. Surprisingly, morphologically complex words, which contain their base word as an embedded word by definition, constituted a negligible proportion of all embeddings in the corpus, showing that the phenomenon of embedding is not an artifact of morphological structure.

In addition to within-word embeddings, words may straddle

word boundaries as, for instance, *sizzle* in *premises along*. Such embeddings were also found to have a high frequency of occurrence: An embedded word straddles roughly one of every five word boundaries in MARSEC. These results show that lexical embedding constitutes a severe problem in real speech input, and that recognition systems cannot assume that the first word they encounter in a sequential input is indeed the intended word.

2.5 Computational modeling

2.5.1 Morphology

R. Sproat (AT&T Bell Laboratories, Murray Hill, NJ.) built a computational implementation of a model of morphological processing in language comprehension developed by Schreuder and Baayen. This implementation has the following components. First, a preprocessing stage gives fast initial access to morphs and polymorphemic units. Second, a frequency-dependent access stage guides access to full lexical entries associated with these units. For complex forms, the access time is determined by the slowest access time associated with a component used to construct the form. A sufficiently frequent complex form is stored in the lexicon, along with its morphological decomposition. Third, given a cubic-time parsing algorithm, whose time-complexity is expressed as a function of the input length n, $f(n) = a + bn + cn^2 + dn^3$, it is assumed that the only non-negligible term is a, which is called the *parse factor*.

The first component explains pseudoaffixation effects: Dutch speakers reject *onfoobar* more slowly than they do *foobar*, because the initial string *on-* looks like a real prefix. The model retrieves the morph *on-* in the preprocessing stage, and is then sidetracked into accessing the lexical entry associated with *on-*, only later rejecting *onfoobar* as a non-word because it cannot access *foobar*. With a non-pseudoaffixed form, there are no morphs to segment the string into, so the form can be rejected at the preprocessing stage.

Components 2 and 3 model access times of complex forms. First, the frequency-dependent lookup of lexical entries allows for model in the lexical access difference between high and low stem-frequency forms. Second, the model explains the lexical access difference between stem- and derived-form-dominant forms. Consider plurals. Plurals of plural-dominant words are accessed more rapidly

than plurals of singular-dominant words. Plural forms of plural-dominant stems are (usually) frequent, thus stored: Parsing also occurs, but the parse factor makes this costlier than direct access. Plural forms of singular-dominant stems are infrequent, therefore not stored, so parsing is the only route; the parse factor, plus the cost of retrieving the component morphemes, explains the slower access.

A deterministic version of this model already provides an excellent fit to the pattern of reaction times to singular and plural dominant singulars and plurals in *-en*. That a good fit can be obtained shows that for this plural suffix the parsing route is very slow, too slow to allow statistical facilitation to significantly speed up comprehension. However, the experimental data on the *-s* plural show that a stochastic version of this model is required. Baayen and Schreuder therefore studied the mathematical properties of a stochastic version of Sproat's implementation. Their simulation studies show that good fits can be obtained with the same model architecture for both the *-en* and *-s* data, with the speed of the parsing route as the crucial parameter. For *-en*, the speed of the parsing route was found to be 300 milliseconds, with virtually no statistical facilitation. For *-s*, parsing is accomplished within 100 milliseconds. At this higher speed, substantial statistical facilitation is observed, both in the model and in the experiment.

2.5.2 The Shortlist model

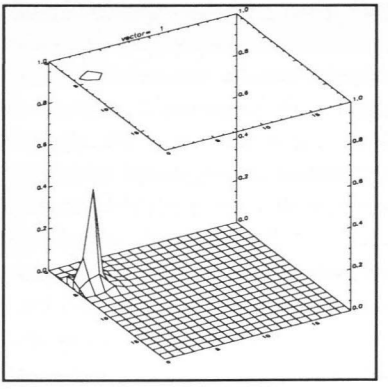
McQueen and Cutler have worked on the development of the Shortlist model with Norris (MRC Applied Psychology Unit, Cambridge). The Shortlist model (Norris, *Cognition* 1994) is a new connectionist model of continuous speech recognition. It has two stages of processing, and information flow in the model is strictly bottom-up. In the first stage, a set of lexical candidates (the "shortlist") is generated, comprising words consistent with any part of the input. This set could be generated by a recurrent network, but the behavior of this network is simulated by an exhaustive search of a machine-readable dictionary. In this way, simulations can be performed using lexicons of over 25,000 words. In the second stage, the shortlist of lexical candidates is wired into an interactive activation network, where competition then operates between the candidates. Through competition, the model settles on a best parse of the input. Competition thus provides a means of both recognizing individual words and segmenting continuous speech.

Recent experimental work by McQueen, Norris and Cutler

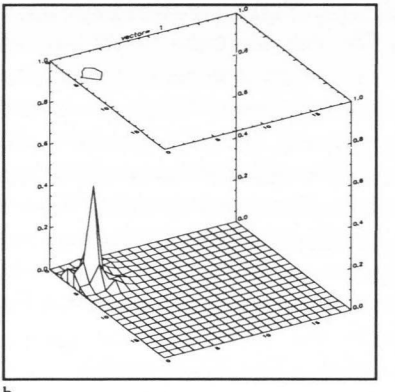
provides strong empirical support for lexical competition, and for its role in speech segmentation. But this and other work also suggests that segmentation is achieved using metrical information. In a stress-timed language like English, word boundaries appear to be postulated at the onsets of strong syllables. Norris, McQueen and Cutler have therefore instantiated metrical segmentation in the Shortlist model. During the exhaustive search of the lexicon, a match/mismatch calculation is performed for segmental information. A word's activation level is increased if it matches a segment in the input, and it is decreased if it mismatches with a segment in the input. Simulations show that a similar mechanism is required for metrical information. The activation level of words beginning at strong syllables in the input is boosted, and the activation level of words misaligned with strong syllables in the input is penalized. This combined boost and penalty procedure allowed the Shortlist model to accurately simulate the human data showing conjoint effects of lexical competition and metrical segmentation.

2.5.3 Sequential processing

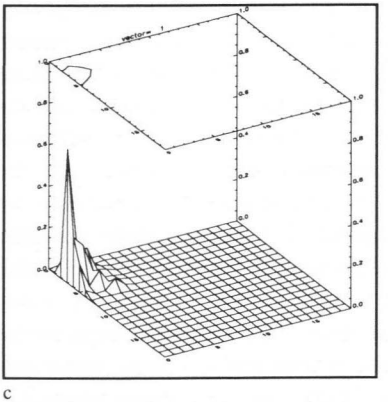
P. Wittenburg has also been involved in connectionist modeling of speech recognition. Together with H. Neggers (U. Twente), Wittenburg has continued to work on the ability of two recently proposed self-organizing algorithms to process sequential information: The "Temporal Kohonen Map (TKM)" and the "Self-organizing Feature Map for Sequences (SOFM-S)" (see Annual Report 1993). The TKM is in many respects equivalent to a Recurrent Network with only self-recurrency. Neurons in a TKM are leaky integrators. They simulate the fact that the membrane potential of real neurons can be associated with a time constant. This means that all knowledge about a sequence has to be stored in one weight vector, and that the impulse response of a neuron has to be a monotonically-falling function. In contrast, a SOFM-S uses trained lateral links. This means that a sequence can be represented by many weight vectors, and that the impulse response of such neurons can carry more complex functions. Such maps can be viewed as implementing stack-like operations similar to Recurrent Networks with fully-connected hidden layers.



a



b



c

Figure 2.1 shows the activity distributions achieved with the current algorithms for the 15x15 p-map. In (a) the activity is shown for the /th/ from the word /thanking/, in (b) the /th/ from the word /thinking/, and in (c) for the /s/ from the word /sister/. These distributions show the amount of overlap and identity for the two versions of the /th/, but also the small differences due to the inherent variation of the speech production. The activity for the /s/ indicates that another phoneme was realized, but it also indicates the amount of confusion between the phonemes /th/ and /s/.

Intensive tests have been carried out with real speech signals. The aim has been to analyze whether TKM or SOFM-S are able to implement a phonemic map. Such a map can be viewed as a robust spatio-temporal filter for speech signals. It is possible to map the incoming speech signal onto phonemic categories using the phonetic context and to indicate similarities between sound segments (see Figure 2.1). First results with CVC words show that the SOFM-S leads to much better representations, especially in the case of sounds like plosives. More research will be carried out to define the optimal parameters for each phoneme class.

2.5.4 The RAW model

D. van Kuijk and Wittenburg further optimized the RAW model (see Annual Report 1993). The development of the phonemic map was optimized by using only selected speech segments during training to realize a better representation of the different phoneme categories. These results again demonstrated that a pure statistical pattern extraction procedure (as applied by most HMM- and ANN-based models) will not lead to satisfying representations of speech sounds. The next step will be to incorporate a combination of this selection technique and the context sensitive methods described above. On the lexical level, some optimizations have been applied by modifying the equations describing the network dynamics. The sensor neuron potential is now calculated from the Euclidian distance (instead of the scalar product) between the input and the weight vector. In addition, better normalization is now done on word neurons. These changes reduced the number of errors in word recognition dramatically. Future work will include integrating lateral interaction, improving the training procedure with a fine tuning phase, and testing RAW with larger lexicons. These modifications and extensions will make RAW a good basis for the simulation of word recognition with real speech input and for the integration of further components, such as prosodic information.

2.5.5 Syllable structure

Wittenburg finished a small project (together with M. Kuitert and L. Boves, U. Nijmegen) on the possibility of extracting syllabic structure information from the speech signal. It was shown that Recurrent Neural Networks have the potential to extract syllable nuclei with high reliability. Similar to the results of Reichl and Ruske (*Eurospeech '93*),

it was possible to get above 90% correct detections in read sentences. Due to the supervised learning strategy, the correct labeling of the training material is of high importance. Some typical errors were indicated. It seemed to be impossible to extract the correct words in sequences such as *zie ik* 'see I', since the two vowels are almost identical, and spoken without a break. Similarly, the network had great problems making the distinction between schwa in a reduced syllable and liquids and nasals in certain consonant contexts. For example, the sequences /br/ and /dr/ were almost always recognized as a short syllable, with schwa inserted between the stop and the liquid. There is obviously considerable acoustic overlap between schwa and other phonetic sequences: These ambiguities must however be resolved in some way by human listeners.

3. Lexical Access in Speech Production

This project investigates how speakers access words in isolation (e.g., in picture naming) and in larger utterance contexts. The research is guided by an increasingly detailed network model of the accessing process. The starting point of the theory is the activation of some lexical concept in the speaker's mind, i.e., a concept for which there is a word in the speaker's mental lexicon. According to the model, activation not only spreads to related concepts, but also "down" to a layer of so-called *lemmas*. A lemma is the word's morpho-syntax. In the model, selecting a word from the lexicon is retrieving its morpho-syntax. The model predicts the time course of lexical selection under a large variety of activation conditions. Upon selection of a lemma, activation spreads to its so-called *lexeme* in the next layer of the network. The lexeme is the word's, or rather morpheme's, segmental and metrical structure. In a process called phonological encoding, this information is used to build phonological syllables, phonological words and phonological phrases. This involves phonological interaction between adjacent words or morphemes, such as cliticization and beat movement. The model specifies how metrical frames are created for phonological words and how the retrieved segmental information is incrementally attached to these frames, "from left to right". The final phase of the model, phonetic encoding, concerns the way in which an emerging phonological syllable triggers the retrieval of a phonetic syllable from a "mental syllabary", a repository of articulatory syllabic gestures. The execution of such gestures, i.e., articulation itself, is still outside the model.

The entire complex encoding process has been implemented by A. Roelofs as a spreading-activation based network with labeled links that is integrated with a parallel, object-oriented production system. The model not only handles many problems that confront other existing models, but it also accounts in detail for the key data about naming latencies obtained by way of the picture-word interference paradigm. It also handles the word and syllable frequency findings that were recently obtained in the project (Annual Report 1993). And it is compatible with classical observational data such as error and tip-of-the-tongue phenomena.

Although this year's research continued previous work, there was increased concern for the generation of morphology, of metrical structure and syllabification, and for lexical access in larger utterance contexts.

3.1 The generation of morphology

The encoding of complex morphological structure was the subject of an extensive study by Roelofs. The experiments tested predictions of his computer model of word-form encoding in speech production (Annual Report 1993). It is characteristic of the model that phonological encoding proceeds incrementally. Phonemic segments are incrementally attached to metrical frames, producing phonological syllables one by one. Phonetic syllables, the stored articulatory gestures, are retrieved one by one, following the creation of phonological syllables. Roelofs extended the model by supposing that the generation of morphology proceeds similarly in incremental fashion. This rightward incremental encoding of morphology was the central issue tested in the experiments.

Rightward incrementality prohibits planning of noninitial morphemes of a word in advance of initial ones. This claim was tested in a first series of experiments using the implicit priming paradigm developed by A. Meyer (see Annual Report 1988). In each experimental trial, subjects had to produce one word out of a set of three words as quickly as possible. In a homogeneous condition, the response words shared part of their form, whereas in a heterogeneous condition the responses were unrelated.

The first experiment showed that the implicit priming paradigm is sensitive to morphological structure. In producing disyllabic simplex nouns and nominal compounds, a facilitatory effect was obtained from homogeneity of the first syllable of the words. The effect was larger when the syllable constituted a component morpheme of a compound than when it did not: a morphemic planning effect. For example, the effect was larger for *bij* in *bijrol* (consisting of the morphemes *bij* and *rol*) than in *bijbel* (consisting of a single morpheme). The outcomes of the next two experiments supported the claim that successive morphemes of a word are planned in serial order. In producing prefixed verbs (e.g., *behalen*), a facilitatory effect was obtained from homogeneity of the prefix morphemes (e.g., *be*), but not from

homogeneity of the noninitial base morphemes (e.g., *halen*). Computer simulation showed that the Roelofs' model accounts for these findings.

In a second set of experiments, Roelofs tested predictions of the model about complex morphology in simple phrasal forms, in particular about the role of linear order, length, and frequency in producing Dutch particle verb constructions. These verb constructions consist of two lemmas (i.e., they are minimal verb projections). Again, the implicit priming paradigm was used.

For particle verbs in a particle-first infinitival form, a facilitatory effect was obtained when the responses shared the particle but not when they shared the base. For example, in producing *opzoeken*, a facilitatory effect was obtained for *op* but not for *zoeken*. By contrast, for base-first imperatival forms, a facilitatory effect was obtained for the bases but not for the particles. For example, in producing *zoek op!*, a facilitatory effect was obtained for *zoek* but not for *op*. As predicted by the model, the effect was much larger for *zoek* in *zoek op!* than for *op* in *opzoeken*. Bases like *zoek* are longer and of lower frequency than particles like *op*. Long fragments of low frequency take longer to encode than short fragments of high frequency, so the facilitatory effect from preparation will be larger. Control experiments showed that the difference in effect was not due to the mood of the verb or to the length of the non-overlapping base (e.g., *op* in *opdoen* produced the same effect as *op* in *opzoeken*).

The experiments also tested for the independent contributions of length and frequency. It was shown that the facilitatory effect from homogeneity increases when the overlap becomes larger (while keeping frequency constant). First, the facilitatory effect increases when the number of segments in the particle increases. For example, the effect was larger for *door* in *doorschieten* than for *aan* in *aanschieten*. Also, the effect was larger when the responses shared both the particle syllable and the first base syllable than when only the particle syllable was shared. For example, the effect was larger for *ople* in *opleven* than for *op* in *opzoeken*. Furthermore, bases of low frequency yielded larger facilitatory effects than bases of high frequency (while keeping length constant). For example, the effect was larger for *veeg* (low frequency) in *veeg op!* than for *geef* (high frequency) in *geef op!*. The outcomes of these experiments support the claim that simple phrasal forms are planned morphologically and phonologically in a rightward incremental fashion.

A third set of experiments tested the model's prediction that "implicit" and "explicit" primes yield independent effects. In the experiments, there were homogeneous and heterogeneous response sets (the implicit primes) as well as form-related and form-unrelated spoken distractors (the explicit primes). Subjects had to produce single words such as *hamer* 'hammer', simple imperatival sentences such as *zoek op!*, or cliticizations such as *zoek 's op*. In homogeneous sets, the responses shared the first syllable (e.g., *ha* in *hamer*), the base (e.g., *zoek* in *zoek op!*), or the base plus clitic (e.g., *zoek 's* in *zoek 's op*). The spoken distractors consisted of the final syllables of the utterances, either a target syllable (e.g., *mer* for *hamer* or *op* for *zoek op!*, the related condition) or a syllable of another word or sentence in the response set (the unrelated condition). The homogeneity variable and the distractor variable yielded main effects, and the effects were additive. Furthermore, the effects were the same for the production of single words, simple imperatival sentences, and cliticizations. Computer simulations demonstrated that the model of Roelofs accounts for these findings.

Morphology was also the topic of further experiments by H. Baayen, W. Levelt and A. Haveman on the generation of plurals. The Annual Report 1993 mentioned the finding of a so-called "plural dominance effect". In picture naming, both plural and singular noun response latencies are substantially longer when the frequency of the plural is higher than that of the singular (plural dominant pairs, e.g., *eye* and *eyes*) than for plurals and singulars when the frequency of the singular exceeds that of the plural (singular dominant pairs, e.g., *nose* and *noses*). Here, the summed frequency of singular and plural was kept constant across the two dominance conditions.

Plural dominant plurals typically denote objects that occur in pairs (*eyes*) or in natural groups (*sheep*, *tulips*), while singular dominant nouns generally denote objects that tend to occur by themselves (*nose*, *scythe*). What would the response latencies be to singular dominant singulars and plurals where the plural nevertheless denotes a natural pair or group of objects? If such singular dominant "natural" plurals (and their singulars) are responded to equally slow as plural dominant "natural" plurals (and their singulars), the dominance effect must be conceptually driven. If, however, singular dominant "natural" plurals are responded to equally fast as singular dominant "natural" singulars

(and their plurals), the dominance effect must be driven by frequency of occurrence.

To study this, a further picture naming experiment was performed. Here, materials were used that had been rated on a seven point scale for the naturalness of the plural, contrasting objects that typically occur as singletons with objects that typically occur in pairs or groups. The experimental picture names varied the frequency relation between the singular and plural and the naturalness of the plural concept, resulting in three different sets of stimuli pairs: (1) plural dominant pairs with a natural plural (*eye, eyes*), (2) singular dominant pairs with a natural singular (*nose, noses*), and (3) singular dominant pairs with a natural plural (*pin, pins*). The fourth logically possible category, plural dominant pairs with natural singulars, was too small to be included in the experiment. For all conditions, the summed frequency of the singular and the plural was held constant.

The results of the picture naming experiment showed a main effect for frequency dominance. Singular dominant pairs with a natural plural (*pin, pins*) revealed shorter response latencies than plural dominant pairs with a natural plural (*eye, eyes*). These results show that the dominance effect does not arise before lemma selection. Otherwise, all natural plurals should have revealed the dominance effect, not just the natural plurals for which the frequency of the plural exceeds that of the singular.

During her stay at the Institute, M. Potter (MIT) studied the implications of her studies of backward priming in picture naming for the lemma-lexeme distinction.

3.2 The generation of a word's metrical shape

The lexeme not only specifies the word's (or morpheme's) segmental structure, but also specifies aspects of its suprasegmental structure, its "metrical frame". It is, however, not well known what suprasegmental aspects are retrieved from memory and what is constructed on the fly. In previous work, P. Meijer showed that retrieving a word's metrical structure does not only entail the selection of a word's phonemic segments; it is independently "primable". Over the last year, he ran three experiments on the role of syllable number. The results of these experiments suggested that the metrical structure only contains

information about the position of the stressed syllable, but not about the word's number of syllables. Both the naming targets *FAK-kel* 'torch' and *DUIF* 'pigeon' are pronounced faster when a prefinally stressed disyllable is given as prime, such as *DIS-tel* 'thistle', than when a finally stressed disyllabic prime is given, such as *do-ZIJN* 'dozen'. Monosyllables and prefinally stressed disyllables both retrieve a metrical structure containing one piece of information: main stress is on the first syllable. The metrical structure of finally stressed disyllables contains the information that main stress is on the second syllable. Syllabicity (i.e., syllable number) in itself turned out not to be a primable quantity in these experiments. But further experiments revealed that another suprasegmental quantity is retrieved during phonological encoding, namely the number of timing slots (for the word's C's and V's). In a computational model of word form encoding that Meijer developed on the basis of these findings, it was assumed that there were no separate C versus V placeholders, but that only the number of phonemic segments (X's) was specified in the lexeme. Thus, the model predicted that a naming target (such as *zenuw* 'nerve') would be named faster when a prime was given with the same number of placeholders (such as *beker* 'mug' or *atlas* 'atlas') rather than primes with a different number of placeholders (such as *perzik* 'peach' or *aanslag* 'assault'), irrespective of the exact alternation between consonants and vowels. This prediction was confirmed in a naming experiment.

3.3 Syllabification and the syllabary

The process of syllabification is among the most controversial aspects of the model described in the opening paragraphs, and it is particularly difficult to study experimentally. In its simplest form, the model makes two assumptions. The first one is that syllabification is a late process. Lexemes are not syllabified; phonological syllables are created "on the fly" when phonemic segments are successively attached to a phonological word's metrical frame (following sonority gradient rules, maximization of onset, etc.). The second one is that each such created phonological syllable activates its unique articulatory gesture, an abstract motor program in the mental syllabary.

The first issue was further addressed by M. Baumann and her findings

indicate the need for at least minimal refinements in the model. Baumann argued that if syllabification is as late as the first assumption above requires, the Dutch syllable- (and word-) final devoicing of /d/ should not arise in a phrase such as *twee pond en een kilo* 'two pounds and one kilogram'. Here *en* is normally cliticized to *pond*, creating the phonological word *pon$den* (where $ stands for surface syllable boundary). If, however, final devoicing precedes phonological word formation or at least "minds" the lexical boundary between *pond* and *en*, the resulting phonological word should be *pon$ten*. This is an empirical issue, which was tested in a careful experiment. It turned out that both phonetic measurements and perceptual judgments univocally showed speakers to produce the latter, devoiced pattern. The minimal extension of the theory required by this finding is that word boundary information (#) is still available at the level of surface syllabification. The incremental generation of the phonological word *pond#en* will then syllabify as *pon$d#en*, where /d/ devoices before #. But the finding is also in agreement with the existence of an earlier stage of *lexical* syllabification (producing devoiced *pont*), followed by resyllabification when the phonological word (*pon$ten*) is formed.

Together with Meyer and A. Linssen (U. Nijmegen), Baumann further addressed the issue of non-lexical, late syllabification by having subjects produce verb forms in their citation form (for instance *war$men*) or in their past tense form (*warm$de*). These productions were interfered with by auditorily presenting subjects with distractor syllables of different types. (For the method used and initial results, see Annual Report 1993.) For both verb forms, both *war* and *warm* were good primes; they speeded up the response as compared to phonologically unrelated distractors. The critical question, however, is whether there is a cross-over effect, *war* being a better prime for *war$men* and *warm* being a better prime for *warm$de*. This should be found if the surface syllable is the planning unit, but not if the deep syllable (*warm* in both cases) is the planning unit. In a critical experiment the cross-over was indeed found for one stimulus onset asynchrony (SOA = 0). In addition, the experiment showed the usual prime length effect (*warm* being a better prime than *war*). A further experiment excluded that the latter was due to the special morphological status of the longer prime (*warm* being the stem of both verb forms). Although further experiments are needed, taken together these findings suggest, on the one hand, that there is no role for stored,

lexical syllables in the production of words. But on the other hand, they suggest that at least lexical boundary information is still around when phonological words are syllabified. It is an open issue whether syllable boundary information arises at a stage preceding phonological word formation.

The second issue, the psychological reality of the notion "mental syllabary", will need further experimentation as well. Levelt and L. Wheeldon (*Cognition* 1994) found support for the notion by showing that words ending in high-frequent syllables were initiated faster than words ending in low-frequent syllables. This syllable frequency effect was fully additive to the word frequency effect. The paper suggested that there is room for alternative explanations of this major finding. In particular, it was mentioned that the effect could be due to the retrieval of high- versus low-frequent demisyllables. Further analyses by Meyer, Wheeldon, and Baayen of the materials used in that paper showed that also high- versus low-frequent phonemes could have played a role. It will hopefully be possible to construct the verbal materials for which these and all other potential contributors to the frequency effect are fully controlled.

Levelt and Wheeldon suggested that the notion of a syllabary may provide another perspective on issues of phonological underspecification. If phonological segments are (in some way or another) underspecified in the mental lexicon, the issue is not so much how they get "completed" in the generation of surface phonology. The syllabary theory does not require that segments are phonologically completed. Its only requirement is that a generated phonological syllable (that may consist of underspecified segments) maps onto one and only one phonetic syllable in the syllabary. T. A. Hall (FAS, Berlin) discussed these issues of underspecification and feature geometry with members of the lexical access group. In particular he wrote an article that critically evaluated Kenstowicz's (1994) *Phonology in Generative Grammar*. Most phonologists assume that the feature [coronal] is privative in the sense that only the plus value, but not the minus value plays a role in the grammar. The consequence of this assumption is that [-coronal] no longer exists as a phonological entity. Several proponents of feature geometry have noted that apparent examples of rules referring to [-coronal] can and should be reanalyzed by invoking underspecification. On this view, labials and velars are

specified for [place] (as well as [labial] and [dorsal] respectively), whereas the alveolars are underspecified for [place] and [coronal]. Given this kind of underspecification the natural class of noncoronals refers simply to [place], and not to [-coronal]. The problem with this approach is that alveolars must be specified for [coronal] (and also [place]) because they need to be included with the segments that comprise the natural class of coronals. What this implies is that [-coronal] is necessary and cannot be eliminated by treating coronality as a privative property.

3.4 Lexical access in larger utterance contexts

3.4.1 Units of phrase and sentence production

What is the span of advance planning for phrases and sentences? In a series of experiments, Meyer presented subjects with pairs of objects, which they were asked to describe with noun-phrase conjunctions (e.g., the Dutch translation equivalent of 'the camel and the chair') or short sentences (e.g., 'the camel is next to the chair'). Each display was accompanied by an auditory interfering stimulus, which was related in form or meaning to the first or second noun of the utterance, or was unrelated to both. The mean reaction time was longer when the interfering stimulus was semantically related to the first or to the second noun than when it was unrelated. This was true for sentences as well as for phrases and suggests that, regardless of the syntactic structure of the utterance, both noun lemmas are selected before utterance onset. The mean reaction time was shorter when the interfering word was phonologically related to the first noun than when it was unrelated. No phonological facilitation was found for the second noun. This suggests that before utterance onset only the first, but not the second lexeme is selected. Thus, the semantic/syntactic planning unit comprises the entire utterance, whereas the phonological planning unit encompasses only its first part.

3.4.2 Ellipsis in partial corrections

Does the speaker semantically or phonologically activate a word that is elided in the syntactic context? B. Schmitt studied the generation of partial corrections, such as *Kiss Peter ... no Paul!* There are good semantic and syntactic reasons to suppose that the target verb *kiss* is semantically and syntactically active in the gap between *no* and *Paul*.

However, because the verb is not articulated at that position in the sentence, it is possible that no phonological activation might be found. The hypothesis that the lemma is active but not the lexeme was tested by means of the picture-word-interference paradigm. The subjects had to describe a sequence of two pictures. The description of the first picture was of the kind *Kiss Peter*. In the second picture, the patient Peter changed to Paul. The subjects were asked to see this change as a kind of correction of a visual scene and to name it aloud (*No...Paul!*). Locked to the onset of the second picture an auditive distractor stimulus was presented. This stimulus was either semantically or phonologically related (or unrelated) to the target verb. On this task the hypothesis predicts semantic inhibition and no phonological priming relative to the unrelated prime. The results showed a trend for semantic inhibition (significant for subjects but not for targets) and no phonological effect at all in case of ellipsis and both semantic inhibition and phonological priming when the verb was not elided.

3.4.3 Gender recency

J. Jescheniak and Levelt (Annual Report 1993) had found that recent access to a noun's gender information (in a picture naming task) facilitates re-access to that noun's gender (in a gender decision task). J. van Berkum investigated whether this mechanism functions in the normal generation of anaphoric reference (for example in a construction such as *The star - it is small*, where - in Dutch - the pronoun is gender marked). In the major critical experiment, subjects saw and labeled two pictures in succession. Labeling the first picture involved producing (gender-marked) adjective noun pairs (such as *kleine ster*) or just the noun (such as *ster*), whereas labeling the second one could have the form det+noun (*de ster*), where det is gender-marked. Not the slightest facilitatory effect of gender recency was obtained. Still, naming the second picture did show a gender priming effect if a same-gender noun (as opposed to a different-gender noun) was visually presented as a distractor in the picture. Hence, the task was adequately gender-sensitive.

3.4.4 Isochrony in connected speech

The metrical structure of lexical items clearly affects their prosodic environments in the production of connected speech. Meyer continued her research on pre- and postlexical timing in speech production (see

Annual Report 1993). In one experiment, target syllables and the following pauses were found to be longer before stressed syllables than before unstressed syllables. For instance, in *De zondige abt BE-tert zijn leven* 'The sinful abbot improves his life', *abt* and the following pause were longer than in *De zondige abt be-KIJKT* ('looks at') *zijn leven.* These findings can be explained by assuming that Dutch speakers initiate the gestures for stressed vowels at approximately even intervals. However, in three new experiments, no further evidence for this hypothesis was obtained. For instance, in sentences such as *Een zwart MAS-ker/ ma-TRAS ligt op het bed* ('A black mask/matras is lying on the bed'), the duration of the target adjective (*zwart*) was independent of whether the noun was stressed on the first syllable (as in *masker*) or on the second (as in *matras*). In these experiments, the targets appeared in different positions in the prosodic structure than in the first experiment, and the target syllables were probably more likely to be destressed before stressed syllables than in the first experiment. Thus, the expected stress clash did not occur and the predicted effects of stress clash on syllable and pause durations were not observed.

If normal speakers tend to regularize the distance between peak-onset to peak-onset between two adjacent words in connected speech by varying the between-word pauses, one might ask what happens to this timing in aphasic patients. C. Heeschen and Patel (Harvard U.) developed a test which included a larger variation of items than used in Meyer's original experiments. Administration of the test to normals yielded some unexpected problems: (1) Normals did not make between-word pauses at all - except if word1 ended with a sibilant, fricative, or stop and word2 began with a stop; (2) Even in these items, a regularization of the between-word pauses could not be found. In order to explore this failure of replication, a new version of the test was constructed. Firstly, only items (or item pairs, respectively) with the effective phonetic make-up were included. Secondly, the subjects were tested under two conditions. In condition A, isolated expressions were shown to the subjects, then put aside and the subjects had to reproduce the expression after 2-3 seconds. In condition B, the list condition, the critical items were invariantly the penultimate item of a list of 5 items. The 4 non-critical items of the list were distractors, but had the same syntactic structure as the critical item and were semantically related to it. In the list-condition (with its specific intonational pattern) the

regularization of pauses could be reliably replicated. In condition A (non-list), no regularization could be found. Between-word pauses and their regularizations are therefore highly dependent on specific intonational-rhythmic factors so that the generalizability of the original findings remains an open question.

4. Argument Structure

The relationship between predicates and their arguments has played an increasingly important role recently in both linguistic theorizing and the study of syntactic development. In linguistics, this relationship is now seen as central to both simple clause structure and complex sentences. In acquisition, verbs and other relational predicates are the child's keys to syntax. The Argument Structure Project was established in 1994 to pursue the understanding of argument structure empirically through two sources of data: crosslinguistic analysis and comparisons of argument structure, and investigations of first language acquisition. The group brings together researchers from different theoretical backgrounds who work on a variety of different languages. By searching for regularities both across languages and in acquisition, the argument structure project addresses fundamental questions about the degree of universalism and innateness of linguistic knowledge. The research carried out in this project is summarized below under four topic headings: identification of arguments and argument structure, predicate classes, argument structure-changing operations, and argument status.

4.1 Identification of arguments and argument structure

A basic problem, both for investigators of adult language and for language learners, lies in determining what the arguments of different predicates are and how they are realized syntactically. As a first step toward a better understanding of how children identify arguments and determine how they should be realized, J. Weissenborn, in collaboration with A. van Hout and S. Powers (U. Maryland), developed coding schemes for French, German and Dutch developmental data. The coding of the data by native speakers is in progress. The coded data will be used to construct verb profiles which will be used to longitudinally study the acquisition of argument structure.

A second investigation related to argument identification is H. Behrens' study of the acquisition of simple verbs vs. complex verbs made from simple verbs by the addition of prefixes and particles. This study is

cross-listed under the Change of State Project; a summary can be found there.

4.2 Predicate classes

A central issue in recent research on argument structure has been to determine the nature and specificity of correlations between predicate meaning and argument structure. A related question is the extent to which children can make predictions about the syntactic behavior of predicates purely on the basis of knowledge of their meanings. Much of the Argument Structure Project's research on predicate classes has focussed on two different types of intransitive verbs; studies have also examined light verbs, and verb classes in the acquisition of Tzeltal.

E. Danziger has been investigating participant marking in Mopan Maya predicates. In Mopan Maya, as in many languages, a lexical split may be observed in the structural behavior of intransitive predicates, such that predicates of one class have affinities with the transitive Actor, and predicates in the other class have affinities with the transitive Undergoer. The intransitive predicates patterning like the transitive Actor (e.g., Mopan *siit* 'jump', or *xik'* 'fly') express action to which the single participant has an active, effecting, initiatory, volitional, or controlling relationship. The intransitive predicates patterning like the transitive Undergoer (e.g., *box* 'be black', *yaab* 'be plentiful') express an action or event to which the single participant has an affected, state-like, resultative, non-volitional, non-controlling relationship.

The existence of these two types of intransitive predicates in Mopan coincides with the existence of an independent semantics of the pronoun affixes which mark predicate participants. The pronoun which marks the transitive Actor, for example, cannot express the single participant of any intransitive predicate that might command a semantically stative construal. (For example, *Tan in-tin-tal* 'I am sitting' – a form in which the transitive Actor pronoun appears – must always be read as inchoative 'I am assuming a sitting position' rather than as a stative 'I am in a sitting position').

Structural facts provide a clue to some of the semantic parameters which govern the intransitive split in Mopan: There is a third and inconsistent class of Mopan intransitives, the members of which sometimes appear inflected like a transitive Actor and sometimes

like a transitive Undergoer. This class consists of predicates (e.g., *tal-* 'come', *tik-* 'dry out', *em-* 'descend') denoting actions which are not necessarily under the voluntary control of the participant, and in which the action results in a new state of affairs for the participant. The factor which conditions case-role marking patterns in this class is completedness of the action, as expressed unambiguously in morphological aspect.

Typological linguistics traditionally treats alternations in case-role marking based on inflections (like this third class) as belonging to an entirely different typological framework from alternations which are lexically based (like the one between e.g. 'jump' and 'be black', described above for Mopan). Inflectional conditioning is usually treated as an example of "Split Ergativity", while lexical conditioning is considered to exemplify a typologically distinct "Active-Inactive" type of patterning. But Mopan is one of many "Active" languages which also shows traces of inflectional conditioning. The semantic similarity, and the historical continuity between inflectional and lexical conditioning of the intransitive split in Mopan indicate that the difference between inflectional and lexical conditioning of the intransitive split represents a typological continuum, not a disjuncture.

Weissenborn, in collaboration with van Hout, J. Randall (Northeastern U.) and H. Baayen, and supported in part by the DFG (German National Science Foundation), continued work on the acquisition of the unergative-unaccusative distinction in intransitive verbs (see Annual Reports 1992, 1993). The two main (and related) questions in this research are these: (i) In view of the crosslinguistic differences in the behavior of intransitive verbs in adult languages, are linking rules universal or do they differ crosslinguistically; (ii) How much of linking is innate and how much needs to be learned? The results of experimental studies on auxiliary selection with novel, intransitive verbs (as reported in Annual Report 1993) showed that, across both languages and ages, semantic factors such as ± telic and ± actor are relevant in linking intransitive verbs – although in different ways. These conclusions were further tested in two ways.

One set of investigations explored the role of syntactic clues. The (a)telicity of intransitive predicates with motion verbs depends crucially on other elements in the VP – i.e., the presence of a locative

or directional phrase, which triggers an atelic or telic predicate, respectively. But German and Dutch are sensitive to different syntactic factors. In German, the semantics of locative and directional prepositional phrases is very much correlated with Case (dative Case gives a locative interpretation, accusative Case gives a directional one). In Dutch, prepositional phrases (e.g., *IN HET HUIS lopen* 'walk IN THE HOUSE') are compatible with both locative and directional readings, but postpositional phrases (e.g., *HET HUIS IN lopen* 'walk THE HOUSE IN') are unambiguously directional phrases. One set of experiments, conducted with Dutch 4-5 year olds, 7-8 year olds and with adults, focussed on the possible effects this syntactic clue has on auxiliary choice in Dutch. In two experiments, telic scenes with novel motion verbs were presented with prepositional and postpositional PPs, respectively. A first comparison of the results shows that the effect of the syntactic clue was basically one of salience: The telic motion scenes were classified as unaccusative in both experiments (i.e., BE was the preferred auxiliary), but more consistently so in the postpositional than prepositional experiment. This suggests that syntactic clues, as well as semantic ones, play a role when people classify new intransitive verbs as unergative or unaccusative.

A second set of investigations tested two hypotheses about how semantic features determine the classification of intransitive verbs: that [+telic] verbs are unaccusative (and so should trigger BE), and that [+actor] verbs are unergative (and so should trigger HAVE). One of the findings of the experiments done in the preceding year was that both German and Dutch subjects classified inherently telic scenes [+inherent, +telic] with a [+actor] subject as unergative (i.e., HAVE was their preferred auxiliary), while they classified compositionally formed telic scenes [-inherent, +telic] (i.e., motion scenes described with a directional prepositional phrase) with a [+actor] subject as unaccusative (i.e., they chose BE). It was surprising that they did not classify both kinds of [+telic, +actor] scenes in the same way. In a linking system in which both semantic features play a role but one takes precedence over the other, the two kinds of scenes should be classified in the same way – e.g., if [+telic] takes precedence, both scenes should be classified as unaccusative, and so take BE. One possible explanation for the diverging results is that subjects might have "misconceptualized" the inherently telic scenes, focussing on the ongoing action rather than on its end state and so choosing HAVE because of the [+actor] subject.

To test this explanation, two new experiments were run with Dutch adults, one with the original scenes, and one in which these scenes were altered so that the change of state they depicted came about more quickly, making their telic status more obvious. The results of the two experiments were very similar – again, the effect was one of salience: Subjects still preferred HAVE for the [+inherent, +telic, +actor] scenes in both experiments, but more consistently in the "slow" than in the "quick" condition. These findings suggest that there is a conflict in the classification of verbs with this particular semantic specification, with the feature [+actor] pulling for unergative status and the feature [+telic] for unaccusative status. Since these scenes were described with HAVE (unergative) more frequently than with BE (unaccusative), the [+actor] feature wins out overall. However, the conflicting [+telic] -> unaccusative classification competed somewhat more successfully in the "quick" condition, which was designed to make the telicity of the scene more salient.

In her six-month visit to the Institute, A. Sorace (U. Edinburgh) continued her research on the grammatical phenomena related to the choice of the auxiliaries ESSERE 'be' and AVERE 'have' with intransitive verbs in Italian. She argued that the unmarked selection of ESSERE with unaccusatives in compound tenses is sensitive not only to a hierarchy of syntactic configurations (as assumed by the early Government-Binding version of the Unaccusativity Hypothesis) but also to a lexical-semantic hierarchy that subdivides the range of unaccusative verbs along the gradient dimensions CONCRETE/ABSTRACT and DYNAMIC/STATIC. This hierarchy identifies the notion of "dynamic change" as the core of unaccusativity and distinguishes "core" or prototypical types of verbs from peripheral ones. A hierarchy can be posited for unergative verbs as well, for which the relevant semantic gradient is TELIC/ATELIC and the core is represented by verbs denoting non-motional activities.

Sorace showed how these lexical-semantic constraints are visible at three levels: (a) There is systematic variability in native speakers' linguistic intuitions, manifested in consistent and determinate acceptability judgments on auxiliary selection with core verb types, and variable and indeterminate judgments on peripheral verb types; (b) Languages display more internal consistency in their manifestations of unaccusativity/unergativity for core verbs than for peripheral verbs; (c)

In the acquisition of Italian as a non-native language, both auxiliary selection and NE-cliticization are acquired with core verbs first, and then gradually extended to more peripheral verb types. These developmental regularities can be explained by assuming that the acquisition of the syntax of unaccusatives crucially depends on the internalization of linking rules which govern the mapping of lexical-semantic representations onto lexical-syntactic representations at the level of argument structure. Within a (potentially universal) multi-dimensional and hierarchical semantic "space", languages may choose different factors as the ones relevant for encoding the grammatical features of unergativity/unaccusativity. This implies that linking rules are language-specific and may in fact be regarded as the main locus of cross-linguistic variation.

In collaboration with Randall (Northeastern U.) and van Hout, Sorace further pursued the issue of the cross-linguistic semantic bases of the unaccusative/unergative split. Both her research on Romance, and Randall, van Hout, Weissenborn and Baayen's research on the acquisition of verb argument structure in Dutch and German (see Annual Report 1993 and above) look at differences among languages at the level of linking rule systems. The bases for a joint project were laid out which – by pulling together the two research strands – will investigate the interface between the syntax and semantics of unaccusativity in learner and adult grammars. Together with W. Vonk and van Hout (and with the assistance of Baayen), Sorace also designed an experiment aimed at testing the validity of the unaccusative and unergative hierarchies with respect to auxiliary selection in Dutch. The experiment, which is currently in progress, makes use of a timed version of the magnitude estimation technique for the elicitation of acceptability judgments, which has been tested in previous studies by Sorace.

Van Hout, in collaboration with B. Hollebrandse (U. Massachusetts, Amherst), investigated the acquisition of the argument structure of so-called light verbs (LVs). Developing a model for verb learning within a dynamic view of the lexicon in which verbs are characterized according to their event type and lexical-syntactic structure, these investigators argued that (i) LVs are easy to acquire, (ii) A child learning her lexicon makes use of the dynamic properties of the

lexicon, and (iii) LVs are core verbs in learning the linking system between lexicon and syntax. These hypotheses are supported by Dutch data (available in CHILDES) from four children followed longitudinally. From early on, children produce a great variety of LV constructions, including overgeneralized ones. Van Hout and Hollebrandse conclude that verbal lexical knowledge can best be represented in a dynamic lexicon and that child language data thus present another source of data for testing lexical theories.

In a study of spatial encoding in children learning Tzeltal (Mayan) (cross-listed under both the Change-of-State and the Argument Structure Projects), P. Brown continued collecting six-weekly longitudinal videotapes of children in four households in the community of Tenejapa, Chiapas, Mexico. Prominent among the children's first words (at around age 1 1/2) are deictic adverbials (*li'i* 'here' / *lumine* 'over there'), demonstratives (*ini* 'this' / *mene* 'that') and presentationals (*ila, ixtal*, formulae uttered on giving and receiving objects), establishing an early basis for the proximal/distal distinction necessary for deictic motion verbs. The children's first verbs include some intransitive motion verbs ('come'/'go' 'enter'/'exit') and their associated directionals (adverbials encoding trajectory towards/away from deictic center, and into/out of a spatially defined region); by the age of 3, 10 of the 16 basic motion verb roots (including such notions as 'go', 'come', 'enter', 'exit', 'ascend', 'descend') are being productively used as finite intransitive verbs, and combined with many different verbs as directionals. The causative suffix is also early applied to a number of these verb roots; indeed, they are among the first intransitive roots to appear in children's speech with a transitivizing suffix, and the corresponding shift in argument structure. In contrast, the shape-encoding positional predicates characteristic of locative utterances in adult speech (see Annual Report 1992) are extremely rare in the children's locatives between the ages of 1 1/2 and 3 years. This suggests that semantic and morphological complexity, and perhaps also the typologically uncommon encoding of shape distinctions in locatives, here correlate with late acquisition.

4.3 Argument structure-changing operations

Across languages there is a broad range of processes that alter the basic argument structure of a predicate by adding, subtracting, or rearranging arguments. An important language acquisition puzzle has been to explain how children come to have an understanding of these alternations that is both productive and appropriately constrained. In 1994, Argument Structure Project members examined children's acquisition of several alternations involving transitivity.

S. Allen completed her Ph.D. on the first language acquisition of three morphosyntactic mechanisms of transitivity alternation in arctic Quebec Inuktitut. Data analyzed were taken from naturalistic longitudinal spontaneous speech samples that Allen collected over a nine-month period from four Inuit children aged 2 years 0 months through 2 years 10 months at outset. Both basic and advanced forms of passive structures (e.g., *iqaluk Jaanimut nirijaujuq* 'the fish was eaten by Johnny') are shown to be used productively by Inuktitut-speaking children at an early age relative to English-speaking children, but consistent in age with speakers of non-Indo-European languages reported on in the literature. Potential explanations of this difference include frequency of caregiver input and details of language structure. Morphological causatives (e.g., *Jaaniup piaraq qiatitanga* 'Johnny is making the child cry') appear slightly later in the acquisition sequence, and their first instances reflect use of unanalyzed routines. Lexical causatives (e.g., *Jaaniup puvirtajuuq qaartanga* 'Johnny burst the balloon') are present from the earliest ages studied. In one subject, overgeneralization of lexical causatives occured at the same time as productive use of the morphological causative. This suggests that the seeming overgeneralization may reflect nothing more than as yet unstable use of the morphological causative. Noun incorporation structures (e.g., *Jaani iqaluturtuq* 'Johnny ate the fish / fish-ate') are shown to be used productively by Inuktitut-speaking children at an early age relative to Mohawk-speaking children. Potential explanations of this difference include details of language structure and relative language use in the environments of the learners. The data presented argue against a maturation hypothesis of language acquisition, and suggests that all functional categories can be accessed by the Inuktitut-speaking child early in the acquisition process.

M. Bowerman and W. Croft (U. Manchester), began a joint exploration of a persistent type of argument structure error by children learning English: the use of obligatorily intransitive verbs as transitive verbs with a causative meaning (e.g., *I vanished the soapsuds* [= made vanish]). Although this type of error has been recognized since Bowerman first reported on it 20 years ago, why it occurs is still a matter of debate (e.g., is it overgeneralizaton of a word formation rule? or is it reliance on canonical sentence schemas?). Why it eventually stops occurring is even more uncertain. As a first step toward a better understanding, Bowerman and Croft are making a detailed analysis of Bowerman's large diary corpus of errors from two children from ages 2 to 14 years to establish which verbs are erred on, whether there are (possibly changing) semantic patterns in the verbs involved or in the nature of the causative events referred to, and what the order is in which the errors fade out. These data are supplemented by less systematic errors from a number of other children, and from adults.

Data patterns challenge Pinker's (*Learnability and cognition* 1989) account of the errors, which invokes the notions of "broad- vs. narrow-range rules", "dynamic event", and "direct causation". From the beginning, errors involve a wide range of verbs (e.g., those denoting states as well as events) and causation types (indirect as well as direct), suggesting that children draw on a highly abstract notion of "causation" from an early age. The late onset of the errors, following a period in which the verbs are used correctly, argues against Braine et al.'s (*J. Child Language* 1990) "canonical sentence schemas" interpretation. Bowerman and Croft are investigating the potential of an inductive activation model of category formation to explain the onset, course, and offset of causativization errors.

In a related study, Bowerman and D. Wilkins worked with R. Van Valin (S.U.N.Y. Buffalo) during his month-long visit to the Institute on the role of "agent" in causative constructions in adult and child language. Many current syntactic theories invoke "agent" as a primitive semantic role selected by predicates, but the notion of "agent" is generally not well-defined. Wilkins and Van Valin have hypothesized that a more relevant notion for language structure is a general concept of "effector" (active initiator in a causal chain); this concept underlies notions such as "agent", "instrument", and "force", with the reading of "agent" arising as a pragmatic interpretation based on a variety of

sources of information. This hypothesis offers a plausible explanation for the patterning of several types of errors in children's speech: For example, overextensions of lexical causatives to refer to situations involving nonagentive causers (e.g., inanimate objects or static situations), and the somewhat indiscriminate use of *by*, *from* and *with* to introduce oblique causal NPs and clauses of different types, suggest that language learners are indeed sensitive to an abstract, overarching notion of effector.

In 1994, U. Brinkmann completed her dissertation, which analyzes the structure and acquisition of the locative alternation (e.g., *smear butter on the bread/smear the bread with butter*), with particular emphasis on how the alternation works in German (see also Annual Report 1992). Like most argument structure changes, the locative alternation in German – in which the goal-object form of the verb is prefixed with *be-* – applies to many but not all candidate verbs. To determine how children can decide whether a verb alternates, Brinkmann has analyzed the structural changes involved in the alternation and the reasons why nonalternating verbs cannot undergo these changes.

According to Brinkmann's Nonindividuation Hypothesis, a verb can alternate only if its theme argument, when not specified, can be construed as nonindividuated (i.e., as an unbounded amount of stuff or objects). When the theme is nonindividuated, its quantificational properties are irrelevant for determining the truth values of sentences containing the verb, so it does not need to be expressed syntactically. This makes the object position available for the goal argument. Only incremental themes can be construed as nonindividuated when not specified. This interpretation comes about when the verb is interpreted as a process predicate. The nonindividuation hypothesis predicts that the alternation will be acquired earlier for atelic verbs like *smear*, which denote only the motion of substances (and so are here termed "mass verbs"), than for telic verbs like *load*, which denote the motion of bounded objects as well as substances (and so are termed count verbs). This prediction was supported in a production and a comprehension experiment. The production experiment also tested Gropen et al.'s claim (*Cognition* 1991) that children are equipped with an innate Object Affectedness Linking Rule on the basis of which they know that affected arguments may be expressed as direct objects. Affectedness influenced only the oldest children (mean age 8 years 11

months) and the adult subjects; for the two youngest groups of subjects (mean age 6 years 4 months and 8 years 1 month), a verb's status as count or mass was important, but not whether it specified an affected object.

The comprehension experiment also tested Brinkmann's Internal Structure Hypothesis, which claims that nonalternating verbs vary in whether they fail to meet a necessary condition that is relevant very early in the derivation of the goal-object form, or a condition that becomes relevant only later. Directional verbs like *heben* 'lift' do not meet the most basic condition: they have incorporated an intransitive spatial predicate (e.g., *hoch* 'high'), so they cannot express the goal as direct object. Causative and accompanied motion verbs can in principle take their goal as direct object, but their theme cannot be construed as nonindividuated. In the experiment, children were asked questions like "What are things you can *be*-verb?" (this taps a speaker's sense of what a verb's direct object is – in this case, whether it should be construed as the theme or the goal argument). As predicted, children listed goal NPs more often for ungrammatical *be*-verbs derived from causative or accompanied motion verbs than from directional verbs; in fact, they hardly ever listed goals for the latter. This result supports the hypothesis that verbs that cannot be prefixed with *be-*, with its accompanying affect on argument structure, resist this operation for different reasons: directional verbs do so for such a fundamental reason that it is almost impossible to interpret *be-* forms derived from them as taking a goal object; in contrast, *be-* forms derived from causative and accompanied motion verbs, although ungrammatical, can more easily be interpreted canonically as taking a goal object.

4.4 Argument structure and argument status

The characterization of argument structure relies in part on the successful identification of "arguments". But determining what constitutes an argument is not always straightforward. Research on this topic in 1994 revolved around processes of noun incorporation.

Allen, D. Hill (CARG) and P. Levy (CARG) conducted an investigation into the adult representation of noun incorporation based on three languages of different structures and typologies: Inuktitut (Eskimo), Longgu (Oceanic) and Totonac (Totonac-Tepehua). Noun

incorporation is a process in which the noun root with the function of logical object appears attached to or in an especially close relationship with the verb rather than as an independent lexical item. The two roots form one unit for purposes of agreement marking, case assignment, and other relevant processes. An example from Longgu is shown in (2), based on the simple declarative in (1).

(1) *ara* *si'o-vi-ra* *na* *niu-gi* *geni-gi*
3PL collect-TRS-3PL PERF coconut-PL woman-PL
'The women were collecting the coconuts.'

(2) *ara* *si'o* *niu* *na* *geni-gi*
3PL collect coconut PERF woman-PL
'The women were collecting coconuts.'

While the essential form of noun incorporation has been uncontroversial since at least 1836, the details of its various manifesting properties and of its structure – especially concerning the component of grammar within which it takes place – have been the topic of considerable debate through the last hundred years. Allen, Hill and Levy extracted claims from the literature concerning both the form and function of noun incorporation, and assessed these in light of data from their languages of study. Though many of the details of noun incorporation in the three languages were similar to claims in the literature, several unusual patterns emerged that bear further investigation. These include the incorporation of nominal phrases in both Inuktitut and Longgu, the severe restriction of which nominals can incorporate in Totonac (only "part of" morphemes), the incorporation of unergatives in Totonac, and the incorporation of case-marked nouns in Inuktitut. Two more general issues also emerged: (1) the role of relationships between possessor and possessed in noun incorporation given that possessed nouns may incorporate in each of the three languages, and (2) the possibility of using noun incorporation as a test for argument status given that only nouns in certain argument structure relationships are supposed to be permitted to incorporate.

5. Change of State

Languages vary considerably with respect to the specific ways in which they categorize and encode notions such as time, space, causation, modality, or possession. Some of these notions, in particular time and space, have been the subject of extensive (earlier and on-going) investigation at the Institute. In contrast to this work, the present project, which started in 1994, will focus on the interaction of several of these categories. The clearest case of such an interaction is that of (simple and complex) expressions which involve a change of state. For example, an utterance such as (1) involves (at least) three of the notions mentioned above – time, space, causation:

(1) John gave the book to Mary.

There is a first state in which the book is with John, and John does something. This action leads to a second state in which the book is no longer with John but with Mary. Hence, (1) involves two distinct time spans, two places (of the book), and an action which causes the change of place. Depending on how we interpret *to give* in this case, there might also be a change of possession, or only a change of possession rather than a change of place (as in *John gave the house to Mary*).

As a starting point, we may say that a change of state event conceptually involves two distinct states – a first state in which something is the case, and a second state, in which this is *not* the case – or vice versa. We shall call the first state, the source state (SS), and the second state, the target state (TS), respectively. Very often, SS and TS only differ by the fact that something has a certain property in the first state but not in the second state. The nature of this property can be very different – it can be spatial, as in *John left*, it can be qualitative, as in *John died*, or a combination of several features. Thus what actually changes in a change of state may vary across verbs; it may be AGENT, THEME, or LOCATION for example. It may also be that the argument structure does not remain constant from source state to target state, for example in verbs of creation or destruction. Other complicating factors include the particular temporal properties of the change (gradual, abrupt, with or without an interval between the two

states, etc.), the degree to which the change of state is lexicalised – ranging from two separate clauses via serial verb construction and particle verbs to single morphemes and the interaction with aspect and tense – to mention only the most important ones. All of this is reflected in languages in different ways; the goal in this project is (a) to explore these linguistic encodings in a wide sample of languages, and (b) to investigate how these particular encodings are acquired in first language acquisition. There will be a series of subprojects which reflect the particular interests of individual researchers. They cluster around the following four main subtopics:

(i) Two states and varying argument structure
(ii) Lexicalization patterns (with special reference to particles)
(iii) Motion
(iv) Change of state on the discourse level (and problems of causal construal)

For the first three of these, several subprojects were begun in 1994.

5.1 Varying argument structure

One problem of change-of-state-verbs concerns the question whether different participants taking part in the initial and the final state of an event can or must correspond to different Argument Positions of a given verb, and if so, in which way. As an initial step to answer this question, M. Bierwisch considered canonical causative verbs as in (2):

(2) (a) John cleaned the house.
(b) John built the house.
(c) John destroyed the house.

The source state (SS) and the target state (TS) of these three types of events differ, among other things, by the fact that the theme argument denoted by *the house* participates in SS and TS of (2a), the TS of (2b), and the SS of (2c), while the SS of (2b) involves raw material, and the TS of (2c), the remnants of the house instead. These considerations might suggest that participants of SS and TS relate to Argument Positions in different ways. To clarify this point, the following assumptions about the structure of change of state verbs will be made:

(3) (a) A state change involves at least an SS and a TS, specified by propositions P and Q, respectively.
(b) In the default case, P is specified by the negation of Q.
(c) Q must be identified as TS in contrast to P, with P providing the precondition for the change to take place.

Suppose that the conditions in (3) are formally represented by (4), where BECOME marks its argument as TS and predicts its negation as the precondition SS:

(4) BECOME (Q)

Adding the causative component as an operator that marks the state change as the direct effect of an agent's activity, we get the standard representation (5) for the Semantic Form of a causative verb like *clean*:

(5) /clean/ x CAUSE (BECOME (CLEAN y))
precondition: NEG (CLEAN y)

x and y provide the Argument Positions for the Agent *John* and *the house* in cases like (2a). According to this analysis, verbs of creation like *build* must be based on a schema like (6):

(6) x CAUSE (BECOME (EXIST y))
precondition: NEG (EXIST y)

This seems to be at variance, however, with the observation that the SS of (2b) does not involve the denotation of *the house*, but rather something like the material from which the house might be built. Two points are to be made to solve this apparent contradiction. First, the source state required as a precondition by the verb does not in fact specify the material that will constitute the house, but only that whatever material might be used, it does not constitute the house in question yet. In other words, the material does not show up in the SS of *build*, just as, e.g., *John left the house* does not specify John's location in TS, except that it is not the house. Second, SS of *build* must refer to the Theme of TS, in order to specify its nonexistence, which is the proper precondition of the verb. The same considerations apply, mutatis mutandis, to *destroy*, where it is the TS that, contrary to initial

considerations, refers to the very Theme that shows up in the precondition.

The conclusion to be drawn from this analysis can be summarized as follows:

(7) Different states involved in one lexical item cannot support different Argument Positions.

It remains to be shown whether this generalisation holds for arbitrary cases, beyond simple inchoative or causative verbs of the sort discussed here. If it turns out to be correct, it states a fairly strong condition on the structure of possible lexical items, as violations of (7) are by no means excluded on purely logical grounds.

5.2 Lexicalisation and aspect

H. Behrens began a crosslinguistic project on the acquisition of the verb lexicon, focussing on the semantic and syntactic effects of lexicalization patterns on language development. Of special interest is the difference between simplex and complex predicates: Germanic languages allow complex predicates to be formed through the attachment of prefixes to simplex predicates (e.g., *machen* 'to make', *aufmachen* 'to open', *vermachen* 'to bequeath'). These prefixes encode the change-of-state properties of an event by specifying the spatial and temporal properties of the simplex base verbs.

German children acquire a vast array of prefixed forms very early, thus encoding aspectual, and especially directional information. There is, however, a distinct order in the acquisition of various types of complex verbs that reflects their semantic and syntactic properties. E.g., inseparable and semantically opaque prefix verbs are a relatively late acquisition. Hence, children systematically "ignore" parts of the linguistic information of the input language and acquire formally defined word classes on a selective, piecemeal basis.

Similar processes hold for the acquisition of the argument structure of these verbs. There is a gradual, linear gain of linguistic knowledge in terms of the realization of arguments and their case marking, but, at the same time, there is a lot of variation at any given point in time: Having productive command of the argument structure of a simplex verb does not imply that the child (a) realizes the

obligatory arguments all the time, or (b) can infer the argument structure of complex predicates derived from it. One objective of further research will be to explore the sources of variation in child language.

W. Klein extended his earlier work on the expression of temporality to Russian and to Chinese. They both have overt aspectual marking, but they also have systematic devices to express change of state – prefixes in Russian, complex verb formation in Chinese, and in both cases, the interaction of these devices with aspect is complex. Essential to Klein's work is the assumption that both tense and aspect can be given strictly time-relational definitions which reconstruct intuitively correct but vague and metaphorical characterisations such as *seen as completed* or *presented in its entirety* etc. These temporal relations, such as BEFORE, INCLUDED IN, and AFTER, are supposed to obtain between three types of time spans: the time of the situation (T-SIT), the time of assertion (T-ASS), and the (usually deictically given) time of utterance (TU). The basic idea is best explained by a simple example such as (8):

(8) Nani was cheerful.

The T-SIT at issue is the time of the situation at which Nani is cheerful. This situation is selectively described by the lexical content of (8). According to the standard analysis of tense, (8) also expresses that T-SIT precedes TU. But clearly, this need not be the case; it may well be that this situation still obtains at TU, i.e., T-SIT may well contain TU. What (8) asserts is rather that there is some time span T which precedes TU, and this time falls entirely into T-SIT. Whether T-SIT itself precedes TU or includes it, is left open: The speaker makes a commitment only for the subinterval T of T-SIT. The time span to which the assertion made by an utterance is confined is called here the time of assertion, T-ASS. Tense then does not express a relation between TU and T-SIT; it expresses a relation between TU and T-ASS, and if the listener knows anything about how T-SIT is related to the utterance in time, then this is by virtue of the fact that T-ASS in turn is temporally related to T-SIT.

According to this view, both tense and aspect are temporal relations between temporal intervals: TU, T-ASS, and T-SIT:

Tense is a temporal relation between TU and T-ASS.
Aspect is a temporal relation between T-ASS and T-SIT.

In the *imperfective* aspect, for example, T-ASS is fully included in T-SIT. This explains the intuitive feeling that *the situation is presented from its interior, or not as a whole, or as being incompleted.*

In example (8), the lexical content of the entire utterance describes the situation as a state (with boundaries, about which, however, nothing is said in this utterance). It is assumed that there are three types of lexical contents: 0-, 1-, and 2-states. In the case of 0-state contents, T-SIT "has no limits" (i.e., if the situation described by the lexical content of the utterance obtains at some time span T, it also obtains at any other time span T'). A situation described by a 1-state content has a beginning point and an endpoint, no matter whether the lexical content says anything about these boundaries. The situation described by a 2-state content has two distinct sub-states, SS and TS. Languages vary with respect to which of these they treat as the "distinguished state" (DS), i.e., the one which behaves like the single state of a 1-state expression.

In cooperation with H. Hendriks, Klein analysed how aspect, defined in this sense, interacts with change-of-state verb constructions in Mandarin Chinese. Chinese lacks inflectional categories (in the traditional sense) to express tense and aspect, but this function is served by other devices, such as adverbials and in particular a small set of particles, the most important of which are *le*, *guo*, *zhe* and *zài*, instead. Chinese frequently expresses 2-state verbs by means of a sequence of at least two verb-stems of which one expresses an action, and the second one expresses the result of this action (so-called resultative verb compounds, RVCs), for example:

(9) Tā xǐ-gānjìng yī-fu
He washed the clothes clean.

As has repeatedly been shown, Chinese allows a very selective assertion; in particular, it is possible to negate the intuitively expected result of actions. In the present framework, in which aspect is a temporal constraint on the assertion, this is explained by the interaction

between the distinguished state and the assertion marking of the aspectual particle. In (10) the normal implicature of the first clause is, that the person is dead, but in Chinese, the negation in the second clause does not lead to a contradiction.

(10) Tā shā-le rén, kěshì měi shā-sī
He killed the man, but he didn't kill him dead

Note that in English, the same effect can be obtained with other verbs. In English, the distinguished state for aspectual marking is (a) the single state for 1-state contents, and (b) SS for 2-state expressions. Thus, the 2-state verb *bake a cake* when in the sentence *John was baking a cake* may make the listener assume that John eventually achieved having his cake – and this assumption may even be the default case. It is not asserted that the target state was reached however, or will be reached.

In Chinese, the distinguished state DS is (a) the single state in a 2-state content, and (b) TS for 2-state contents. The meaning of the different aspectual particles is as follows:

le	T-ASS overlaps PRETIME T-DS AND T-DS
guo	T-ASS after T-DS
zhe	T-ASS INCL T-DS
zài	T-ASS INCL T-DS

It could be shown that uses of the aspectual particles in combination with various situation types have the same constant meaning, i.e., the one given above. This in contrast to a large number of traditional accounts for the meaning of the aspectual particles in Chinese. For example, the particle *le*, according to the traditional literature, expresses perfectivity, but also in some cases inchoativity. The present analysis easily explains this ambiguity. Consider (11):

(11) Tā pàng-le
He got fat.

This utterance has a perfective reading (roughly *he was fat*), but also an inchoative reading (roughly *he got fat*). Since the analysis of the particle *le* only requires an overlapping of T-ASS with T-SIT and its

pretime, it is possible that T-ASS totally includes T-SIT and part of its pretime (perfective reading), but also that only the beginning part of the situation is included in the time for which the assertion is made (inchoative reading).

In (12), a case of *le* in combination with a 2-state verb, the meaning of *le* stays exactly the same (this in contrast to the traditional accounts of *le* where *le* now has the second meaning, perfectivity), namely T-ASS overlaps with PRETIME T-DS and T-DS. The source state in (12) is <she be alive>, the target state <she be dead>. Both overlap with T-ASS, in other words: Within the time for which an assertion is made, there is first a phase where she is alive and then a phase where she is dead. This is the perfective reading which corresponds to English *she died.*

(12) tā sǐ-le
She died.

Aspectual particles are not obligatory. If there is no such particle, then no relation between T-SIT and T-ASS is specified. This can mean one of two things:

(a) No assertion is made at all.
(b) An assertion is made, but the relation between T-ASS and T-SIT is left to pragmatical considerations.

But even if there is an assertion particle, e.g., *le* in example (10), the assertion may not include the target state, and hence, it is not asserted that this target state was ever reached. Depending on the particular context, this may be implied – but it is not asserted, and therefore, (10) is not contradictory.

S. Stoll began her dissertation research on the first language acquisition of aspect in Russian. On both semantic and morphological grounds, the system of aspect marking in Russian is quite complex. It has been stated in previous research that, from early on, children do not have any difficulties with aspect in the Slavic languages. It seems, however, that data which are available so far for Russian and Polish are not sufficient for such strong claims, and hence this issue should be studied further. The major aim of this research is investigating the cognitive basis for

aspect and the acquisition of aspect. In order to find out which factors play a role in the acquisition of aspect, two experiments were designed, a production experiment and a comprehension experiment. Since it is well known that children up to age three have difficulties with picture stories, Stoll developed an experiment based on video material. To test the comprehension of both aspects (perfective and imperfective) a split-screen technique was used. In this decision task, particular attention is paid to the diverse morphological aspect markers and the inherent temporal structure of the verb (Aktionsart). The experiments were tested in a pilot study in St. Petersburg and the comprehension task proved to be feasible for children under three years of age.

B. Bickel finished his dissertation research on aspect, mood and time in Belhare, a hitherto undescribed Sino-Tibetan language of Nepal. The study starts off from three descriptive puzzles. (a) The 'mood' system builds on two cross-cutting oppositions: one between associative (with present or future reference) and dissociative (with past or counterfactual reference), and one between indicative and subjunctive (with non-assertive, "backgrounding" function). Whereas relative clauses in the dissociative require subjunctive mood, they do not follow this restriction in the associative (where indeed the indicative is more common). What is the reason for this rule distribution? (b) In the associative, there are four aspectual forms that compete in the description of progressive and iterative situations. What is the difference and how do speakers chose between the forms? (c) Dissociative, aspectually unmarked forms of a verb like *khatma* 'to go' are regularly used for present time reference (or so it seems) whereas the same forms from a verb like *cekma* 'to say' are restricted to past time or counterfactual reference.

The puzzles can be solved under the assumption of modularity (or, at least, strict level differentiation) in meaning composition. Solutions are proposed that keep to the distinction between semantics and pragmatics, and, with respect to the problems (b) and (c), to the distinction between grammatical ('viewpoint') aspect and Aktionsart.

The theory of aspect and Aktionsart employed derives from work by Johanson, Breu, and Sasse. The crucial hypothesis, which is confirmed by the analysis of Belhare, is that aspect markers are defined as selectors of boundaries and/or phases in Aktionsart structure and that Aktionsart structure can be reduced to regular alternations of (static or

dynamic) phases and boundaries. This implies that aspect and Aktionsart are distinct but that they involve compatible, if not homomorphous, concepts. The study of Belhare motion verbs and their habitual value in the temporary aspect suggests that the notion of Aktionsart should be expanded so as to incorporate not only syntactic additions of boundaries or phases but also pragmatic enhancements. Bickel's dissertation concludes with the hypothesis that the concepts of phase and boundary replicate through all levels of representation from grammatical aspect marking up to pragmatic implicature.

5.3 Motion

D. Wilkins and D. Hill continued work with other members of the Cognitive Anthropology Research Group on the cross-linguistic comparison of so-called deictic motion verbs. Comparing COME and GO expressions in Mparntwe Arrernte (Australian) and Longgu (Oceanic), it is questionable whether the set of notionally-defined motion verbs corresponds to a formally-defined verb class in any language, and there are certainly languages with no formally identifiable subclass of verbs whose members all express motion. Further, COME is not a strict lexical universal, nor is GO if we require it to be lexically deictic, but a non-deictic GO form may be a strict lexical universal. Finally, the GO form in at least some languages is not deictic, so if there is a universal deictic opposition manifested by COME and GO forms, it is at the level of pragmatic interpretation not lexical semantics – which argues for the need to keep semantics and pragmatics modularly separate.

Using data collected and analysed by F. Ameka (Ewe), B. Bickel (Belhare), P. Brown (Tzeltal Mayan), E. Danziger (Mopan Mayan), D. Hill (Longgu), P. Levy (Mexican Spanish), E. Pederson (Tamil), C. Stolz (Yucatec Mayan) and Wilkins (Arrernte and Italian), Wilkins has identified a preliminary lexical semantic typology of COME expressions. These data were collected using the same questionnaire in an attempt to ensure comparability of data. Crucially, this research tool attempts to identify basic lexical semantic components, and seeks to minimise pragmatic extensions. For all languages studied, the COME expression (or expressions, as the case may be) entail a vector aligned towards the Deictic Center. However, the expressions from these eleven languages actually divide into four

distinct lexical semantic types based on two intersecting parameters: (i) is the expression inherently telic? (i.e., does it entail arrival at a goal?), and (ii) is the Deictic Center considered to be the crucial reference point with respect to which the motion vector is (goal-) oriented, or can some other (intermediate) place be the reference point for (goal-)orientation of the vector (with the vector merely aligned with D.C.)? These cross-linguistic distinctions between COME expressions are presented in the following table:

	+ telic [i.e. path must arrive (finish) at a point]	+/- telic [i.e. path may or may not arrive (finish) at a point]
• vector is aligned towards D.C. • vector is not oriented to any other reference point	I. LONGGU SPANISH (Mexican)	II. ITALIAN
• vector is aligned towards D.C. • vector may be oriented towards another (intermediate) reference point	III. EWE TZELTAL [jul]	IV. TAMIL ARRERNTE MOPAN MAYA YUCATEC TZELTAL [tal] BELHARE

Table 5.1: Preliminary crosslinguistic typology of COME expressions

P. Brown has continued work on motion verbs in the Mayan language Tzeltal, establishing the basic semantic components in the lexical set of sixteen motion verb roots (see Annual Report 1993:94) and arguing for their semantic coherence as change of state verbs. The semantic components they encode are path-anchor(s), path trajectory, path shape, region/boundary, and aspectual incipience and termination. Tzeltal is of typological interest because it displays the characteristics of both verb-framed and satellite-framed languages (see Annual Report 1992).

Tzeltal motion verbs (like those in Spanish, French, Italian) encode path of motion in roots translating as (for example) 'come'/'go', 'ascend'/'descend', 'enter'/'exit', 'arrive here'/'arrive there', 'return', 'pass

by', 'go across', 'remain behind', 'begin/finish'; in this respect Tzeltal is a verb-framed language in L. Talmy's typology. But the very same roots appear as grammaticalized adverbials modifying verbs or predicate adjectives by indicating the trajectory of the action or event (e.g., *och tal* 'it entered coming'), or of the stative situation (e.g., *lom al tal*, 'very heavy coming', i.e., 'it was heavy (while I was) coming'). These directionals are "satellites" in Talmy's sense. Both as finite verbs and as directionals these roots are among the most frequent in the language (in route-description tasks they constitute up to 80% of the verbal roots); they also appear very early with their language-specific semantics in the speech of Tzeltal children (see Section 4.2).

G. Senft began field research on motion verbs in Kilivila, the Austronesian language of the Trobriand Islanders of Papua New Guinea. Motion verbs were elicited using the "Route Description Task" developed within the space project. In this interactive game, two consultants - a matcher and a director - are facing a model landscape. The consultants are next to each other, facing the same direction. However, they are screened off from one another so that they cannot see each other. The director is asked to describe a route that is indicated on her or his landscape by a chain, to the matcher, so that the matcher can let a small doll walk this route. Descriptions of four different, though standardized, paths were videotaped with three pairs of male and female adult players each. After the transcription of the data, the documented motion verbs were discussed with additional consultants to get further lexical semantic information. First results indicate that the Trobriand Islanders differentiate their motion verbs according to the following criteria:

- Is the source and/or the path and/or the destination of the motion known or not?
- Is the motion oriented towards, or away from, the speaker?
- Is the motion the speaker refers to deictically anchored in the speaker?
- Is the place of the speaker at the destination of the motion or not?
- Is the destination of the motion another place or another person than the speaker and her/his place?
- Is the focus on the inception or the conclusion of the motion event?

Moreover, there are certain motion verbs that express other (complex) notions like 'to go down to the beach' or 'to go up to the village'.

6. Space

This project investigates the relation between linguistic and non-linguistic representations of space, with particular emphasis on cross-linguistic and cross-cultural comparison. It is part of a general strategy to investigate the relation between language and other aspects of cognition in selected domains, using cross-linguistic differences and parallels as one way of investigating the central role of language in general cognition. To pursue this strategy, it is necessary to obtain detailed data on both linguistic and non-linguistic aspects of cognition in cultures that are not part of the Western tradition. This allows us to investigate not only universals but also parameters of variation, and further to ask how linguistic differences in semantic structure relate to properties of conceptual structure and non-linguistic coding in this central domain of human cognition. To this end, during 1994 extended fieldwork was conducted by specialists in the Mayan languages Mopan (E. Danziger), Tzeltal (P. Brown, S. Levinson), Tzotzil (J. Haviland, L. de León), Yucatec (S. Gaskins, J. Lucy, C. Stolz), the Totonacan language Totonac (P. Levy), the Austronesian languages Tonga (G. Bennardo), Kilivila (G. Senft), Longgu (D. Hill), the Bantu language Kgalagadi (S. Neumann), the Khoisan language Hai||om (T. Widlok), the Australian language Arrernte (D. Wilkins), the Dravidian languages Tamil and Bettu Kurumba (E. Pederson), the Tibeto-Burman language Belhare (B. Bickel) and Japanese (S. Kita, K. Inoue). In addition detailed work was conducted on the acquisition of spatial expressions in various languages including Dutch, English, Korean (M. Bowerman & S. Choi), Tzeltal (P. Brown), Tzotzil and Guugu Yimithirr (both de León). Naturally, cross-linguistic comparison is not the only way of obtaining insights in this domain: Fundamental problems in the analysis of the semantics and underlying cognition of spatial expressions were also explored in single languages by W. Levelt and R. Nüse.

The field material is of two main types: language production in specially designed tasks, supplemented by natural language usage, and performance on non-linguistic cognitive tasks, supplemented by observation of naturally occurring spatial behaviour and cultural uses of space. The nature of the non-linguistic tasks was described in the 1993 Annual Report, and some preliminary results announced. We

recapitulate briefly here.

Following initial linguistic work, it appeared that the major cross-linguistic variation in spatial description concerns which *frames of spatial reference* are employed to describe different spatial arrays or trajectories. It seems that there are three major frames of reference or coordinate systems, which we call Absolute (based on fixed bearings like north and south), Relative (based on perspectival concepts like 'in front (of me)', 'to the left') and Intrinsic (based on object coordinates like 'behind (the house)', 'at the tip of the post', etc.). These have different logical and conceptual properties. For example, unlike the Relative frame of reference, a spatial array described in an Absolute frame of reference will receive the same description when viewed from the other side (the cup will still be, e.g., north of the plate, from whichever angle the array is viewed). These different properties of the frames of reference allow us to investigate independently the relation between a subject's linguistic coding and his or her non-linguistic coding (e.g., for the purposes of memory or inference) of a spatial array. For example, a subject who is given a cup to his left (say, north) and a plate to his right (south) and is then rotated 180 degrees and asked to rebuild such an array, and produces the cup to his right (north) and the plate to his left (south) is probably utilizing an Absolute frame of reference in the coding of the scene for recall. In the 1993 Annual Report, we reported the initially surprising result that speakers of languages where the Absolute frame of reference is dominant will tend to perform non-linguistic tasks using an Absolute Frame of Reference, while speakers of a language that would employ a Relative frame of reference in the same domain will tend to perform non-linguistic tasks using a Relative frame of reference. In short, there is good evidence that linguistic coding corrolates strongly with the way spatial distinctions are conceptualized for non-linguistic purposes.

Work has continued on these issues, and more extensive results now support this conclusion. In this report however, we will focus on a particular aspect of this work, namely more detailed research into exactly how and under what circumstances different languages select different frames of reference to describe the same spatial arrays. Here we will exemplify how linguistic data is elicited, analysed and compared. Such steps are necessary prerequisites for developing hypotheses concerning the relation between language, culture and cognition in the spatial domain.

6.1 The comparative analysis of spatial descriptions

In the 1992 Annual Report we presented the concept of the interactional tasks that have been developed for the focused elicitation of expressions of spatial reference. Here we describe one such task, a photo-photo matching game called "Men and Tree" which was developed to elicit spatial reference to relationships in the horizontal plane. This game consists of 4 subgames with two identical sets of 12 photos each. One set is for the "director", the other is for the "matcher", sitting side by side, screened off from one another as shown in Figure 6.1; the task requires the matcher to identify each photo that the director describes, from that description alone, augmented by answers to any further queries the matcher may put to the director. A subset of these photos (2.3-2.8; see figure 6.2) was designed to elicit spatial reference to (i) transverse standing relationships in the horizontal plane between a featured (man) and a non-featured (tree) object and (ii) differences in facing orientation of the featured object (using 90 degree rotation variation).

Many languages have systems of expressions utilizing each of the three frames of reference; but some lack systematic sets of expressions in one or more frames of reference (e.g. they may lack systematic Absolute or Relative spatial expressions). Where languages permit more than one system, speakers nevertheless tend to prefer at least one frame of reference for a particular kind of spatial information in a particular context. The questions for us to answer here are: What are these preferences and why, where, and when do we find them in the elicitated data.

To answer these questions we need a method of extracting the systematic features of spatial descriptions in the Men and Tree games as follows (the method was devised by Wilkins). One first analyses the data with respect to what distinguishing propositions are manifested in the clauses the director and the matcher use for the description of each photograph. A "distinguishing proposition" is one which allows a matcher to narrow down the search-domain within the subset of the photos under consideration. Every description of the photos that succeeds in allowing the matcher to select the photo described by the director contains one or more of these distinguishing propositions. For each paired interaction we can tabulate the distinguishing propositions.

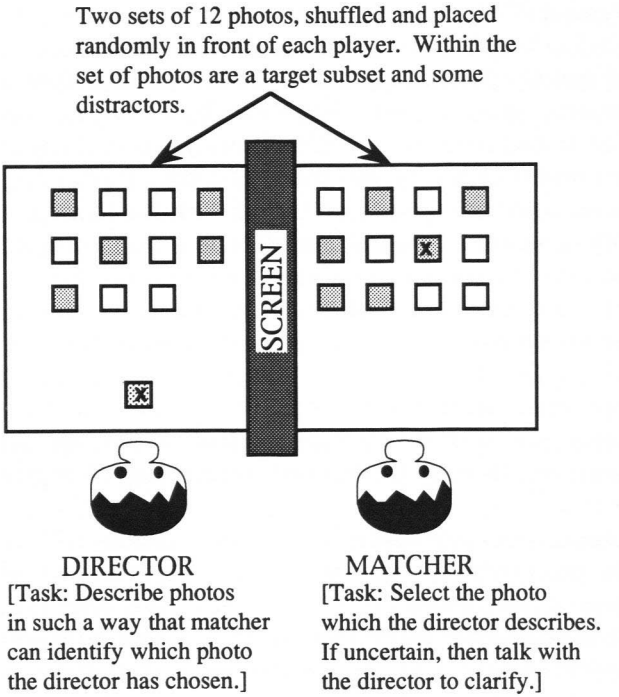


Figure 6.1: Set up for Men and Tree game

Each field researcher summarized the data in a standardized coding format. In what follows we will look at only those languages where data were collected from at least three pairs of consultants: Tamil (Dravidian: Pederson), Arandic (Pama-Nyungan Australian: Wilkins), Hai||om (Khoisan: Widlok), Tzeltal (Mayan: P. Brown), Belhare (Tibeto-Burman: Bickel), Yucatec (Maya: Stolz), Dutch (Indo-European: E. Messing), Japanese (Japanese: Inoue), Mopan (Mayan: Danziger), and Kilivila (Austronesian: Senft).

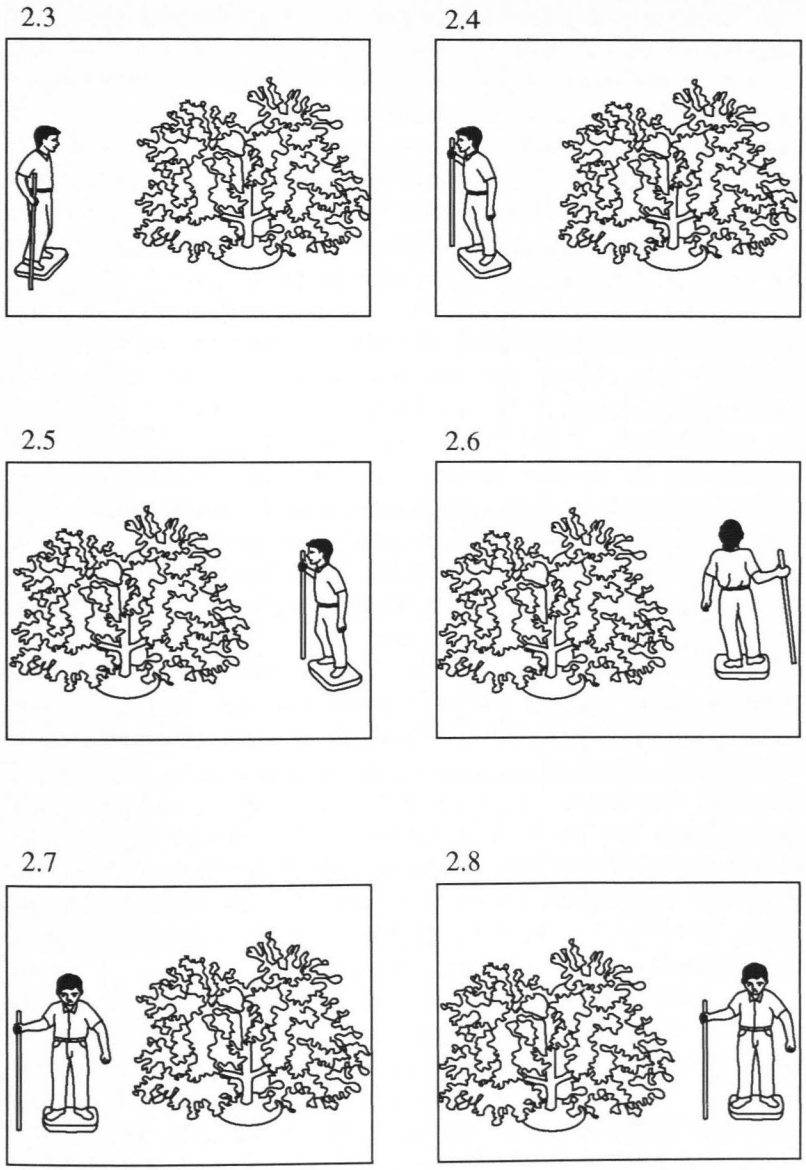


Figure 6.2: Drawings of the Men and Tree photos 2.3-2.8

For any target subset of pictures in a particular game, two propositions are functionally equivalent if, in the context of play, they distinguish the same subset of pictures from the rest. Similarly, a system of related propositions are functionally equivalent if they reveal exactly the same pattern of contrasting subsets. This functional equivalence is independent of semantic relatedness, and holds true both within the set of propositions used by a pair for a certain game, and across the sets of propositions which arise from different pairs playing the same game within and across language groups.

The individual propositions for each pair in each language community were categorized according to the systems of spatial reference they convey and assessed as to their status as possible functional equivalents in the sense defined above. We first categorized the propositions found in the data according to whether they represented the speakers usage of an Absolute, Relative, Intrinsic, and/or Deictic system of spatial reference. To subcategorize these systems further, we also noted the absence/presence of the following additional distinctions that are characteristic for these systems (this relies on typological work done by Bickel, Levinson, Pederson, Wilkins and others): (i) The Absolute system can be subdivided into systems with cardinal axes (e.g., north, south, east, west) and with "terrain"-based systems (with conventional and ad hoc (local) landmarks). (ii) The Relative system can be subdivided according to criteria that are based on viewer parts or perspectival coordinates - left/right, front/back, versus those that use e.g. an undifferentiated "across" axis. (iii) The Intrinsic systems, finally, can also be subdivided into those that utilize detailed partonymies of the Ground object, and those that superimpose a system of "sides". In the latter case, 'front', 'back', 'left', 'right' or related assignments can be made without taking the perspective of the viewer into account.

Table 6.1 summarizes the spatial proposition types and the spatial systems used by each language community to differentiate the target photos in Figure 6.2 of the Men and Tree matching task. Language communities are ordered such that groups with similar patterns of usage are placed near one another in the table. The numbers in each cell of the two tables refer to the number of game pairs which used the respective spatial proposition type. In what follows we will briefly comment on the patterns which emerge from the Table.

	ABSOLUTE ('geo'-based)				RELATIVE (Anthropo-centric 'metric' projection)			INTRINSIC (spatial-scene centered / anchoring of spatial description is within scene)					DEIC-TIC
	Cardinal axes (to horizon)		'Terrain'-based		Physio-morphic (based on viewerparts)			Physio-morphic (based on ground/figure parts)				Ascribe Physio	'Depth'
	N-S (eg M stands in the north)	E-W; sunrise-sunset (eg T stands in W)	Conventional (eg sea-inland)	Ad hoc land mark (eg M facing road)	L-R (eg M to [our] left)	F-B (eg S is in back, for us [not M])	Undifferentiated 'across' (M face across)	L-R (eg T is to M's left)	F-B (eg T is in front of M [ie M's front])	specific body part (eg M's chest to tree)	Other (eg T & M side-by -side)	F-B [ascribe from M to T]	Person-Deictic (eg M facing us)
Tamil (n = 4)	4	3	—	—	—	2	—	—	—	2	—	1	3
Arandic (n =3)	2	2	—	—	—	—	1	—	2	—	2	—	3
Tzeltal (n = 3)	—	1	3	2	—	—	—	—	3	2	2	—	2
Hai//om (n = 4)	—	3	2	—	1	—	—	1	2	—	2	—	3
Belhare (n=3)	2	2	1 + *2?*	2	2	1	*2?*	3	3(seq)	1	—	—	1
Yucatec (n = 4)	1	1	—	3	2	—	—	2	4	1	4	1	4
Dutch (n=3)	—	—	—	—	3	1	—	1	—	2	3	—	3
Japanese (n=3)	—	—	—	—	3	—	—	2	—	2	1	—	3
Mopan (n = 3)	—	—	—	—	—	—	—	1	2	2	2	—	3
Kilivila (n = 6)	—	—	—	—	—	—	—	6	6	4	2	—	6

Table 6.1: Spatial proposition types used to differentiate target pictures in Game 2 of 'Men and Tree'

The table shows the following: (1) All 10 language groups used descriptions from the Deictic system of the sort 'towards us', 'away from us'. (2) All 10 groups used some form of Intrinsic spatial description, although 3 of the 10 groups show no use of left/right propositions of the Intrinsic system – e.g. 'at the man's left hand' (instead, these three groups prefer the use of propositions of the Absolute system). (3) In general, little Intrinsic usage (that is to say, little usage of propositions that are categorized as belonging to the Intrinsic system of spatial reference) entails much Absolute usage, and little Absolute usage entails much Intrinsic usage. (4) In particular, where a language group shows no use of Intrinsic left/right, this entails their use of Absolute spatial propositions. Similarly, no use of Absolute spatial propositions entails left/right Intrinsic usage. Of course, this does not mean that the use of the Intrinsic system entails the non-use of the Absolute system, and vice versa – and this is also documented in Table 6.1. (5) Any group which uses left/right propositions of the Relative system of spatial reference, also uses left/right propositions of the Intrinsic system of spatial reference (a typological prediction made in the 1992 Annual Report). It should be noted, however, that the reverse is not true here (as documented by the Kilivila and Mopan data). (6) In our sample, those language groups which show the use of propositions of the Absolute system also have a systematic distinction rooted in the 'sun passage', which is either abstracted into East-West regions or which is particularly anchored to 'sunrise' and 'sunset'. (This opposition can either form a major axis of the Absolute system, or be an overlay on a more basic fixed direction system.) (7) The use of left/right propositions of the Relative system tends rather strongly to be in complementary distribution with the use of propositions of the Absolute system. In groups with both Absolute and Relative left/right systems, pairs of game players tended to settle on one or the other.

Such observations allow us to start classifying language communities. It should be stressed that this classification is a context-dependent classification, i.e., it merely claims that a preferred choice of system holds only for this (or an analagous) context of usage. It should also be pointed out that, since all languages encode Deictic distinctions, this classification makes reference only to the Absolute, Intrinsic, and Relative frames of reference. Following this classification, for spatial arrays of this kind, speakers of Arandic, Tzeltal, Hai||om, and many speakers of Tamil tend to use an Absolute frame of

reference, those of Belhare and Yucatec show no clear preference, Dutch and Japanese speakers strongly prefer the Relative one, and Mopan and Kilivila speakers strongly prefer Intrinsic.

It is necessary to emphasize that there is a difference between languages and their speakers having available a linguistic system for spatial reference on the one hand and applying it functionally to the specific contextual task that is presented on the other. Thus, for example, Mopan speakers do not use conventionalized landmarks for spatial reference in any context. Speakers of Kilivila, on the other hand, use conventionalized landmarks in a number of other situations, but they did not apply this Absolute frame of reference in the particular context created by this photo-photo matching task. Another example is provided by different kinds of Tamil speakers: Those tabulated here come from rural communities, where the Absolute frame of reference is preferred in this game context, while members of urban Tamil communities prefer the Relative frame of reference (a tendency being explored in detail by Pederson).

The use of spatial systems is not distributed equally across types of information to be conveyed. For example, Arandic "standing on a transverse axis" was only conveyed, in the context of this task, using Absolute propositions, while in Dutch this information was only conveyed using Relative propositions. However, speakers of the two languages are more similar with respect to the spatial systems they use to convey facing information. In both cases, "facing on a transverse axis" shows the preference of Intrinsic propositions (e.g., 'man has face/chest/stomach to tree'), while "facing on the away axis" shows the preference for Deictic propositions (e.g., 'man towards me/man away from me'). It appears that when there is a "person" or another animate object in the described spatial scene that is facing towards the speaker – thus establishing a kind of facial social encounter situation – then Deictic propositions override other common, or even preferred, methods of spatial description, though these other methods are in principle also applicable in this situation. In contrast, when the "person" or animate object in the spatial scene to be described is turned to the side (i.e., facing on the transverse axis), Deictic descriptions give way to other means. Thus the choice of system is also dependent on specific aspects of contextual information to be conveyed. From the point of view of language-based hypotheses to feed into a non-linguistic cognitive experiment we would, for example, come up with the following

predictions for Arandic: If the (contextually analogous) task involves "standing on the transverse", we strongly predict use of Absolute frame of reference, if the task involves "facing on the transverse" we predict non-Relative behaviour, and if the task involves "social facing on the away axis" then we predict use of the Deictic system.

The research has shown that with respect to spatial reference and the verbal expression of spatial conceptions language communities differ much more than was initially expected. However, it seems that these differences within and between language communities are quite systematic: (i) the number of general spatial systems used seems to be limited, and (ii) given a constant context, speakers within a community tend to be relatively consistent in the choice of which spatial system is to be used to successfully convey particular types of spatial information present in this specific interactive task.

We have exemplified current methods for the comparison of spatial description across languages. On the basis of these observations, the typology of spatial reference systems has been extensively revised and refined, and a better understanding of the corresponding experimental results on non-linguistic tasks has been achieved.

6.2 Frames of reference in language, cognition and culture

The general typology of frames of spatial reference has been a major focus. Levinson and other members of the project, especially Bickel, Danziger, Pederson and Wilkins, have tried to clarify the fundamental underlying notions. Each of the three major kinds of coordinate systems used in language has different logical properties, and also different properties under the rotation of the viewer, rotation of the landmark object (Ground or relatum,) and rotation of the thing to be located (Figure or referent). The rotation properties allow the generation of a sequence of experiments designed to explore non-linguistic coding in memory and inference (see Annual Report 1993), and its correlation with linguistic coding. Levinson has explored how each major type of coordinate system can be seen to be built on a set of fundamental concepts and operations, and this allows us to predict a range of variation to be found in languages. He argues that we should distinguish Deictic coding which encodes no angular information from Relative coordinates which do so; this then helps untangle some of the

confusions in the psycholinguistic literature as to whether e.g., a description of a route from a fixed viewpoint is Deictic or non-Deictic, as opposed to a description from within the route (the former utilizes Relative coordinates, the latter Intrinsic). Once we have clarified the notion of a frame of reference, we can go on to explore which frames of reference are employed across a range of mental faculties by different populations. For example, from work by P. Brown and Levinson it seems that Tzeltal-speakers of Tenejapa (Mayan community in Mexico) not only verbally code arrays using Absolute coordinates, but also do so when coding for non-verbal memory and inference (see Annual Report 1993). Furthermore, even when recall tasks are designed to involve visual imagery, the same system of fixed coordinates is used even though visual images are viewpoint-dependent (or Relative in nature), forcing mental rotation when the subject is rotated. And at least some of these subjects systematically utilize fixed coordinates during unconscious gesture (see Gesture Project). Thus there appears to be some kind of cross-modal or cross-faculty tendency to utilize one main frame of reference – which one differs according to the language one speaks. The explanation for this can probably be found in the following important principle: Information in one frame of reference cannot, with certain specific exceptions, be converted into another. Thus if a language only allows the use of one frame of reference for certain spatial descriptions, non-linguistic memory must code information in those terms if our general ability to speak about anything we have observed is to be retained.

This picture is complicated by work by Levelt on ellipsis during spatial descriptions of visual stimuli by speakers who prefer either a Relative or Intrinsic frame of reference. When a speaker describes part of a visual pattern which consists of coloured dots, connected by lines as follows: *go right to a yellow dot. Then to a green dot*, what is the intended direction of the second move? In case of *surface ellipsis*, the word *right* is elided and the intended direction is to the right. If the speaker's chosen perspective is Relative (i.e. what is often referred to as Deictic), this means going on in the same direction as the previous move (which was also to the right). However, if the speaker's chosen perspective is Intrinsic (the direction of the last move being the base for the next one), going right means turning off the previous course, making a right turn. In case of *deep ellipsis* the intended direction is

"same as previous one". If the chosen perspective is Relative this amounts to the same as surface ellipsis (i.e., going on in the same rightward direction). But if the perspective is Intrinsic, deep ellipsis means NOT turning off the previous course. Deep ellipsis is perspective-*independent*. In an analysis of 616 experimentally elicited pattern descriptions, Levelt found 43 cases of spatial ellipsis. Of these, 42 conformed to the deep ellipsis pattern. In other words, speakers decide to elide a spatial direction term on the basis of a property of the visual pattern, not on the basis of a perspective-dependent lexical concept (such as RIGHT). The question is now, how can this finding be reconciled with the notion that visual cognition is perspective-dependent?

Inoue explored the use of different frames of reference in Japanese. Generally speaking, the primary frame of reference is Relative (as in English), and this also shows through in non-linguistic tasks. However, detailed analysis of the language of description in spatial tasks shows interesting complexities, with rapid, apparently uncued shifts between Relative and Intrinsic frames of reference. For example, in a task in which a director describes a path through a model world to a visually screened-off matcher who must move a toy through an identical world, the director may switch frame of reference half a dozen times to describe a short segment of the path. Analysis shows that the relevant spatial expressions may be specialized to one frame of reference, or may be ambiguous across both, or may even require both for their proper use. Thus, for example, the axis away from the speaker can be expressed exclusively in the Intrinsic frame of reference by *shoumen* and *ushiro*, the across axis by *migi* and *hidari* which are exclusively Relative, *temae* and *mukou* for the away axis are ambiguous, involving one frame of reference at a time, while *tate* and *yoko* involve both frames of reference for their interpretation. What is surprising is that the ambiguous terms can be used in neighboring clauses by the same speaker with different frames of reference. Somehow, in ways not yet clear, this does not confuse the matcher.

Bickel explored the frames of reference that speakers of Belhare (a Sino-Tibetan language of Nepal) use when orienting themselves linguistically and how this relates to patterns of culturally regimented "symbolic" behaviour. This seems to require a further refinement of our

notions of frames of reference. The most common system of Belhare spatial description is constituted by a set of operations that determine how a co-ordinate system is mapped onto the world. These operations include what may be called ecomorphic (determination by gravitation), small-scale geomorphic (by landmarks such as a hill top), large-scale geomorphic (by cardinal directions), personmorphic (by a person), physiomorphic mapping (by intrinsically featured objects) and, as non-spatial extensions, chronomorphic (temporal), aristomorphic (social) and mensural mapping. The operations can be shown to be semantic (rather than pragmatic) in nature and to affect grammar. This does not imply, however, that they are encapsulated in a specifically linguistic domain of cognition. The operations rely on specific cognitive matrices ranging from perceptual experience to situation-specific travel practices, which suggests that they are defined in a general conceptual format of representation. However, the same spatial operations also structure to a significant degree the formulaic enactment of symbolism in culturally regimented practices (such as weaving, praying, house building, etc.) and ways of feeling and experiencing dreams. Since practices and feeling patterns are unlikely to be governed cognitively by conceptual (predicate-argument) representations, the homology between language and symbolic "orthopraxis" suggests that the spatial operations are ultimately defined in a cognitive format that informs linguistic, conceptual and non-conceptual cognition alike or, alternatively, that the operations replicate through all these domains, so that we can easily talk and think about what we do and feel in culturally regimented ways.

Danziger has explored an interesting homology between spatial language and possessive constructions and notions in Mopan (Mayan language of Belize). In the Men and Tree task described above, speakers provide no information other than that actually about Figure and Ground in order to locate the two with respect to one another. Instead, a part of the Ground object (e.g., *t-u-tzeel* 'at his side') is used to specify the relation of Figure to Ground. A linguistic frame of reference which makes use of no information other than about the Figure and the Ground themselves in the expression of spatial relations is an Intrinsic frame of reference. The Intrinsic frame of reference is thus "orientation-free" (in contrast to the "orientation bound" nature of the other frameworks), and consequently does not support consistent

transitive inferences or other logical deductions.

In Mopan, the Intrinsic frame of reference is encoded in the obligatory possessive construction. But that construction also applies to relationships outside the domain of space – for example, kin relationships are also expressed in this way. It can be argued that the logical properties (non-converseness and non-transitivity) which apply to expressions for spatial relationships under the Intrinsic frame of reference, also apply to 'non-spatial' relationships in this language. Application of Intrinsic logic may in fact be specified by the Mopan possessive morpheme itself.

The name given to any particular Mopan family relationship (e.g., *suku'un* 'brother, cousin', *tataa'* 'uncle, grandfather, older cousin') is determined by the perceived degree of entitlement to religious respect of the senior party. Because of this articulation with respect for age, Mopan kin relations are not converse. Small babies are sometimes juniors (*its'iin*, 'little sister') but not seniors (*kik* 'big sister') in the system, and very old people often the reverse. Again, because of the fact that Mopan kinship nomenclature is determined by respect for age, the degree of respect assigned to an individual can not be genealogically predicted. For example, if Alter is Ego's generation-mate for respect greeting purposes, and Alter greets someone else as 'senior generation'. Ego cannot be sure whether she should also greet that person as 'senior generation'.

The property of transitivity therefore also does not hold within the Mopan domain of kinship relations, anymore than it holds among Mopan spatial descriptions. Danziger concludes that an Intrinsic way of viewing both spatial and kinship relations prevails among the Mopan. She invokes the fact that both kinds of relations are expressed in terms of "parts" of a socially constructed whole, to account for this. The question then arises as to whether a well-bounded notion of purely "spatial" relations can actually be identified in this language.

6.3 Acquisition of spatial expressions: Caused location, motion and the acquisition of frames of reference

Bowerman continued her collaboration with S. Choi (San Diego State U.) on the early development of spatial words in a crosslinguistic perspective. In earlier work on spontaneous speech (Annual Report

1991), Bowerman and Choi had found that children learning Korean and English – two languages that express spatial relations semantically and syntactically in strikingly different ways – categorize space language-specifically by as early as 20 months. A subsequent study in which descriptions of a set of spatial actions were elicited from child and adult speakers of English, Korean, and Dutch showed that 2-year-old children classify spatial actions significantly more similarly to adult speakers of their own language than to same-age children learning other languages (Annual Report, 1993).

In 1994, supported in part by the U.S. National Science Foundation, Bowerman and Choi began a full-scale crosslinguistic project (English, Korean [tested in California] and Dutch [tested at MPI]) using the "preferential looking paradigm" pilot tested earlier with Dutch babies (Annual Report, 1991) to further explore how children's nonlinguistic perceptual and conceptual understanding of space interacts with the particular organization of space displayed in the linguistic input. In this technique, the child simply sits on a parent's lap in front of two TV monitors. Previous research has shown that when two scenes (e.g., a ball and a boat) are shown concurrently, and when a verbal stimulus (e.g., *Look at the BALL!*) is presented simultaneously, children as young as 13 months tend to look longer at the matching screen if they comprehend the word.

In one of Bowerman and Choi's studies, infants between about 14 and 24 months see sets of two spatial actions; for example, putting a block INTO a fitting hole in another block (features: containment and tight fit) and putting a block ONTO another block (surface contact, support). The target word heard in English and Dutch is (*put*) *IN*; in Korean it is *KKITA* 'put to a fitting relationship'. Children learning all three languages, should look at the "in" scene in this case. The following pair of scenes splits apart the features associated with the previous "in" scene and shows them separately: putting Legos into a basket (containment) and joining two Legos (tight fit). On hearing the same target word again, learners of English and Dutch vs. Korean should now look at different scenes – the "containment" vs. "tight fit" scenes, respectively – thus showing a grasp of the language-specific contours of the spatial categories.

In a further extension of crosslinguistic research on the semantics and the acquisition of words for spatial actions, Bowerman and de León

(Reed College) began to analyze speech data collected from adult and child speakers of Tzotzil Mayan, spoken in Mexico. The data consist of both spontaneous characterizations of spatial actions and productions elicited using the same set of stimulus actions as used by Bowerman and Choi in testing child and adult speakers of English, Korean, and Dutch. There are typological differences between the 4 languages for which data is now available: English and Dutch are "satellite framed languages" (information about Path is typically in particles like *in* and *up*), Korean is "verb framed" (information about Path typically in the verb), and Tzotzil (like Tzeltal; see below) systematically has both path verbs and path particles. Preliminary findings show both similarities and differences in the child and adult data from the four languages. Computational modelling by J. Boster (U. of California at Irvine) has helped to construct a framework for the systematic comparison both of children versus adults within a single language, and of children at various stages across languages. On the basis of this modelling, one can trace the development of children towards the adult spatial language; this work shows that even at the initial stages children do not appear to start from a common set of assumptions.

As preliminaries to cross-linguistic work on the acquisition of motion expressions, there has been detailed work on the semantics of motion predicates. D. Slobin (U. California, Berkeley) has continued a crosslinguistic study of the effects of linguistic typology on the acquisition and use of spatial language, described in the 1993 Annual Report. In 1994, he carried out systematic searches of all of the English child language materials in the CHILDES database, analyzing the use of verbs of motion and associated satellites and prepositional phrases. Continuing work on sign language, Slobin and N. Hoiting (U. Groningen) have proposed an overall typology of verbs of motion, for both spoken and signed languages, with developmental and psycholinguistic implications. Following up earlier work on typological influences on the description of motion events in novels (English as a satellite-framed language versus Spanish as verb-framed), Slobin has applied the same methods to Turkish (verb-framed), finding similar patterns to those previously ascertained in Spanish.

As described in section 5.3, P. Brown has continued work on motion verbs in the Mayan language Tzeltal. Work now proceeds on a

longitudinal study of the acquisition of Tzeltal, with special attention to the acquisition of these spatial expressions. A parallel study is being conducted by de León (Reed College) on the closely related language Tzotzil, based on detailed semantic studies by Haviland (Reed College), which may make interesting points of comparison. The Tzotzil study already has some interesting results: For example, contrary to predictions in the literature, the stressed path particles are not acquired before the main verbs which express much more detailed spatial information.

There is also increasing information on the acquisition of an Absolute frame of reference. De León has shown that for Tzotzil children, there appears to be a sequence of stages in the acquisition of Absolute expressions: Initially, they seem to be interpreted as egocentric deictics, they then come to be identified with local landmarks, and only in the final stage (around the age of five or six) are they used as true cardinal-direction like terms. She has also explored the acquisition of the cardinal direction system in Guugu Yimithirr, a Pama-Nyungan of Queensland language. Children are bilingual in English and Guugu Yimithirr, and there is a complex sociolinguistic situation with some families using Guugu Yimithirr more systematically than others. Nevertheless, a cross-sectional study of 58 children of ages 6 through 14 shows that half of them end up learning at least the rudiments of the system by that final age. Again there is a developmental sequence, with an initial assumption that the term for 'east' (which for sociocultural reasons is prominent) is a Deictic; later it comes to be associated with specific landmarks, then with a region; then a polar contrast term ('west' or sometimes 'south') is learned, and at the same time the expressions are understood to have a fully abstract directional significance. This last stage occurs at about nine; children may then go on to build the full quadrant system, but this is dependent on the sociolinguistic status of the extended family. In this process, both cognitive maturation and linguistic acquisition seem to be involved.

Lucy and Gaskins (both U. Pennsylvania) have pursued the issue of the role of language in conceptual development as part of a long term study. Previous work comparing Yucatec Maya and American English speakers adults revealed cognitive differences in memory and classification associated with the number marking patterns of each

language. A series of experimental studies with children from the two groups found no comparable cognitive differences at age seven but substantial differences in line with the adult patterns by age nine. This suggests that the influence of specific languages on thought occurs considerably later in development than might have been supposed given the degree of fluency exhibited by seven year olds. Ongoing work is attempting to pinpoint the crucial changes in this period and to extend the empirical work to a second linguistic domain (case marking) and to more complex cognitive tasks (reconstructive memory and inferential reasoning). Although number is presumably a distinct conceptual domain from space, the methods have been important in the development of methods in the space project, and the results may have a general significance across domains.

6.4 Semantics of spatial expressions

The space project is naturally much concerned with the detailed semantics of spatial expressions in many languages. But there are also general questions about how such expressions should best be analyzed. One recurring question is whether spatial expressions are often ambiguous across frames of reference or polysemous across conditions of application, or whether they have a single unitary meaning understood differently in different contexts. This is mostly treated as a theoretical issue. But work by R. Nüse suggests that it can be seen to be an empirical issue, for which definitive answers can be found. He has demonstrated this by working on the resolution of polysemy in the German prepositions *an*, *auf*, *in* and *unter*. Spatial topological prepositions like these exhibit a high degree of polysemy in that different regions of an object may be denoted by the same preposition (e.g., 'the writing/the bird on the sign-post'; 'the water/the flower/the crack in the vase'). Nüse's PhD-project focusses on the question of how listeners derive the specific place of a relatum from the meanings of the preposition and of the other items in a sentence, respectively. Based on the results of his studies using the predicate verification task (see Annual Report 1993), he contrasted two possible models of these "derivation processes": The so-called "preposition shifting model" assumes a "narrow meaning" of a preposition, which does not cover all of the possible uses of that preposition, and thus has to be shifted in certain cases. For example, the meaning of *auf* could be something like

HIGHER THAN PLUS CONTACT, which fits in typical cases like *der Vogel auf der Straße* 'the bird on the street'.

In cases like *die Schrift auf dem Plakat* 'the writing on the poster', however, this meaning has to be shifted because the writing is not literally "higher than" the poster. In these cases, HIGHER THAN has to be "reinterpreted", as it were, e.g., by assuming that the vertical is defined with regard to the direction of the gaze here. In the so-called "object-shifting model", on the other hand, the meaning of a preposition is assumed to be a general one covering all of the possible uses. Thus, it is in no need of reinterpretation. If, for example, the meaning of *auf* is something like CONTACT WITH SURFACE, this meaning fits in both *der Vogel auf der Straße* and *die Schrift auf dem Plakat*. In this model, therefore, the meaning of the preposition is fixed, while the "value" of SURFACE varies with the object in question. (Similar accounts can be given for the other prepositions investigated.) As a consequence, both models make different predictions as to which the "deviating", "effort-requiring" uses of a preposition are. According to the first model, it matters whether the place of an object fits to the supposed "narrow" meaning of the preposition or not. Correspondingly, comprehension of expressions like *die Schrift auf dem Wegweiser / dem Plakat* 'the writing on the sign-post / the poster' should involve additional processing steps compared to expressions like *der Vogel auf dem Wegweiser/ der Straße* 'the bird on the sign-post / the street'.

By contrast, the crucial question in the object-shifting-model is whether an object has a clear surface or not. According to this model, both *der Vogel auf der Straße* and *die Schrift auf dem Plakat* are the easy cases, because a street and a poster both have clear, albeit differently orientated, surfaces. The difficult cases, according to this model, are the ones involving "ambiguous objects" like *die Schrift/ der Vogel auf dem Wegweiser* 'the writing / the bird on the sign-post', since a sign-post represents more than one "surface" for things to be on. Thus, it has to be "decided" which of the two surfaces actually is meant.

The results obtained so far suggest a difference between prepositions: *auf* and *unter* behave as the object-shifting model predicts, while *in* and *an* come up to the predictions of the preposition-shifting model.

Further questions arise as to just how "spatial" different lexemes are. One source of information comes from languages which

implicitly classify their lexemes by verbal and other concord. S. Neumann worked on the final stages of a dissertation on the description of locative class nouns in Kgalagadi (Bantu), based on extended field research. The Bantu languages are well known for their many noun classes, which govern verbal (and other) concord. Some of these classes clearly presuppose a detailed spatial ontology, as can be clearly seen in Kgalagadi. In that language, locative class nouns consist of a stem and a prefix (*ha-*, *mo-*, *qa-*, *xo-*, *xa-*, *bo-* or a ø morpheme). Locative class nouns determine locative concord. The prefixes *ha-*, *mo-* and *qa-* re-occur on locative class nouns and on non-locative class nouns. Non-locative class nouns determine non-locative concord (when not suffixed by a locative). Non-locative class nouns have to be suffixed simultaneously by a locative ŋ when prefixed by one of these locatives. This locative suffix creates place as an entity (as Ameka has suggested for Ewe), whereas the locative prefixes *ha-*, *mo-* and *qa-* refer to various spatial relations of Figure and Ground. The locative suffix requires either a locative prefix on a non-locative class noun or a motion plus path verb that encodes the relation of the Figure to the Ground. A third form class of "inherently" locative class nouns are like locative class nouns never suffixed by a locative but nevertheless determine non-locative concord. These are nouns like place names, sometimes cardinal terms and nouns denoting 'fields, lands' or 'fire place'. "Inherently" locative nouns are – like locative class nouns – not suffixed by a locative because they are already substantially locative. They may function alternatively as locative class nouns or non-locative class nouns. Names of human beings and nouns encoding relationships are a fourth substantival form class. They are never suffixed by the locative but prefixed by *xo-* instead. The locative prefixes *ha-*, *mo-* and *qa-* on these nouns require the prefix *xo-*.

The substantival form classes from top to bottom of the table are on a scale of specificity, i.e., locative class nouns are less specific than "inherently" locative nouns. "Inherently" locative nouns tend to be less specific than non-locative class nouns, while nouns denoting relationships and names are most specific. In contrast locative class nouns are nearly always used in a possessive construction while nouns denoting relationships and names (that may be prefixed by *xo-*) are never used as the possessed entities (some "inherently" locative class nouns like place names are similarly only rarely found in possessive constructions as possessed). Thus the different morphosyntactic

SUBSTANTIVAL FORM CLASS	CAN BE SUFFIXED BY -ŋ	MAY DETERMINE LOCATIVE CONCORD (without being affixed by a locative)	EXAMPLE
LOCATIVE CLASS NOUN	never	always	*xo-rímo* 'up, above, top'
"INHERENTLY" LOCATIVE NOUN:	(no)	(no)	
Type 1)	never	yes/no	PLACE NAMES
Type 2)	yes	yes/no	*ma-simó* 'fields, lands'
NON-LOCATIVE CLASS NOUN	yes	no	*i-tu* 'house'
NOUNS THAT MAY BE PREFIXED BY XO-	never	no	*tatɛ* 'my father'

Table 6.2: Form classes and locative concord in Kgalagadi

properties clearly distinguish an ordered series of nominals of different types which correspond to different kinds of spatial notions.

6.5 Spatial language and behaviour in specific cultures

While investigating spatial descriptions during fieldwork, researchers attempt to understand the full cultural and linguistic background to spatial language. These enquiries naturally lead to linguistic and cultural specificities of some detail. Some examples will suffice.

Hill worked on the notion of PLACE in Oceanic languages. It has been noted by linguists that many Oceanic languages have a small set of nouns referring to a spatial reference point in the lives of the speakers (for example, home, village, bush, sea). She suggested two reasons why it was worth paying attention to the notion of PLACE as represented by these inherently locational nouns. The first reason is that the notion

of PLACE is reflected in conventionalised landmark-based (Absolute) direction systems, which are also frequently found in Oceanic languages. The second is that an analogy can be drawn between the way the grammar distinguishes direct (or inalienable) possessive constructions (in which local nouns may function as heads) from indirect possessive constructions (in which they may not). It was argued that the underlying semantics of both grammatical distinctions have much in common because they both express a distinction between what constitutes the essential part of one's life and what does not. In tying these points together, it was further argued that a landmark-based directional system can mirror what is going on elsewhere in the language, just as it reflects the environmental and cultural situation in which such a directional system is used.

Widlok completed a dissertation which analyses the social relationships of a group of northern Hai‖om, who also call themselves =Akhoe, in the Oshikoto region of Namibia, as expressed, amongst other things, in the use of space. The Hai‖om are a Khoisan-speaking group, labelled "Bushmen" or "San", who were dispossessed of their land during the colonial period. Today most Hai‖om combine hunting, gathering, agriculture, handicrafts, wage labour, and cattle-keeping in a mixed economy. Based on long-term participant observation with the Hai‖om, this thesis shows the flexibility and versatility of Hai‖om social organization and its institutions, and in particular how social relationships are established on the basis of material transactions (sharing, gift-giving, etc.), grounded on shared classifications of land and its resources, and constructed everyday social interaction. Patterns of Hai‖om social practice involving these social relations emerge in language pragmatics, the usage of space, and in ritual activities. These can be best understood as a set of instituted social practices centered around open accessibility and informal common ground.

This open accessibility is particularly visible in the diversity of Hai‖om settlement patterns, although special methods are required to bring out the contrast with neighbouring sedentary Bantu peoples: A "permeability map" can be drawn by establishing the number of social spaces a person needs to enter a particular place from another place or from outside the camp. When analyzed from this perspective, what at first sight are diverse camps show patterns that are reproduced as a group moves camp and as the composition of a local group changes. In

contrast to the Bantu settlement patterns, there is a high degree of permeability and any hut added to an existing camp has the same properties as the huts already established. No individual hut stands out or has a "thicker" boundary than others, but there is a marked difference between fireplaces which can be accessed freely from various directions and the interior of a hut access to which is controlled by the fireplace. These features correspond to everyday routines of visiting or joining a camp and of sharing food within a camp. Boundaries between huts and between "insiders" and "outsiders" more generally become less permeable in the course of sedentarization, in the use of permanent buildings and the emergence of core families as the main unit of residence and of exchange. The boundaries "thicken" progressively when moving from a non-permanent camp of a hunting and gathering group to the semi-permanent gardening season camp and finally to the permanent wage labour settlement. This is true with regard to the external boundary, separating the settlement from its "environment", and with regard to the internal boundaries that separate individual living quarters from communal dwelling places.

On the basis of comparisons between Hai||om camps in different socio-economic situations and between camps of a changing local group over four years, Widlok concludes that the Hai||om maintain neither an ideal-type blueprint nor a large number of different cognitive models for the arrangement of domestic space. Rather the social practices of sharing food, of visiting and greeting, and of leaving and joining camps produce a pattern of permeability which is transformed as the socio-economic framework for these practices change. The Hai||om case suggests that socially shared attitudes about bodily proximity and the permeability of space, structure the relation between settlements as physical events on the one hand and the spatial behaviour and orientation of individual persons on the other hand.

In addition to investigating spatial arrangements in camps, Widlok also explored linguistic expressions for direction and location in Hai||om. The group uses an Absolute frame of reference for many purposes, and detailed investigations were made about the underlying cognitive abilities. Using a satellite-locational system, Hai||om dead-reckoning abilities in the Kalahari were investigated. The results show the Hai||om to be outstandingly skilled, though this skill is demonstrably for cultural reasons (rather than the constitutional or metaphysical reasons invoked by their neighbours).

I. Hoëm (U. Oslo) has been investigating the conceptualization of space on Tokelau, an atoll society located in the South Pacific, north of Western Samoa, with approximately 1500 inhabitants. Through a focus on social relationships, a recurrent pattern of conceptualising space is found across semiotic domains such as formal speech making, everyday speech, dance, and the general organisation of the environment. This recurrent pattern is produced by an interaction between features of social organisation and spatial categories such as *mua* 'front', *muli* or *tua* 'back', *luga* 'above', *lalo* 'below', *loto* 'inside' and *fafo* 'outside'. The main argument shows how the *Lebenswelt* produced by Tokelauans assumes a tight integration between the social organisation of physical (bodily) and environmental space, and shows this integration to have moral and aesthetic connotations. This cultural orientation, then, results in a prevalent and specifically Tokelau "sense of place".

7. Gesture

Four main lines of research were conducted. Two of them concern "spontaneous gestures", which are largely unconscious, unconventionalized, co-speech gestures. The first study investigates *why* people gesture. It pursues the possibility that people gesture partly because gesture facilitates a certain aspect of speech production. The second study investigates *how* space is represented in gestures by Dutch speakers in The Netherlands and Tzeltal speakers in Mexico. It studies whether the difference in the gestural representation between the two cultures parallels the difference in the semantic systems for spatial description. The third study proposes a new classification of various spontaneous and conventionalized gestures. The fourth line of research does not concern spontaneous gestures, but concerns a conventionalized auxiliary sign language used among (non-deaf) speakers of Arrernte (Aranda) of Central Australia. A study of such conventionalized systems can be a useful aid to understanding how to identify and characterize spontaneous gestures.

In addition to these four lines of research, naturally occurring gestures accompanying speech have been investigated by a number of researchers. J. Haviland (Reed College), for example, has compared the pointing gestures in Guugu Yimidhirr and Tzotzil, and has shown that the notion of "pointing" is more complex and culturally variable than had been thought.

7.1 Spontaneous gestures and visual information retrieval

J.P. de Ruiter performed an experiment to test the hypothesis that many spontaneous gestures are not made for the sake of the listener, but rather to help the speaker speak. Gesturing was hypothesized to facilitate the speaking process by: (1) facilitating the retrieval of visual information from memory and (2) keeping visual information active during the process of message encoding. Subjects had to describe geometrical pictures to another subject, while they could not see each other. When subjects had to memorize the pictures before describing them, they gestured more than when they could describe the pictures

directly from the screen. This result provided evidence for the first hypothesis that people often gesture in order to facilitate the retrieval of visual information from memory and is at least consistent with the second hypothesis.

7.2 Gestural representation of transverse spatial relationships

S. Kita, S. Levinson, and P. Brown have focused on the representational content of spontaneous gestures, and its cross-linguistic variation. More specifically, the study investigates how transverse spatial relationships are represented in spontaneous gestures by Tzeltal and Dutch speakers. These two speech communities are chosen for comparison because previous studies showed that the two languages employ quite different linguistic systems to represent transverse relationships. In Dutch, transverse relationships (at least on a non-geographic scale) are described with the terms "right" and "left", – the description of object relations must change with changing orientation of the speaker. This type of system is called the *Relative linguistic frame of reference*. In Tzeltal, similar relationships are typically described by the terms "uphill" (roughly south), "downhill" (roughly north) and "traverse" (east and west). These descriptions do not depend on the body orientation of the speaker. This type of system is called the *Absolute linguistic frame of reference*. (See section 6 for details.) A similar distinction between two possible frames of reference may lie behind different kinds of gestures representing spatial events. This difference between the two gestural frames of reference becomes apparent when a speaker gestures under 180 degree rotation after stimulus presentation.

It was hypothesized that the linguistic frame of reference and the gestural frame of reference for the same kind of spatial context will match. A subject had to remember a short video segment in which cartoon characters or real human actors move in the transverse directions. Then the subject, after rotating 180 degrees, told the story to a listener. Most of the Dutch subjects consistently performed relative gestures, which supports the hypothesis. The preliminary Tzeltal data suggest that there are absolute gesturers, relative gesturers, and people who switch between a series of relative gestures and a series of absolute gestures. Taken together, it can be concluded that there is at

least a partial match between the linguistic and gestural frames of reference.

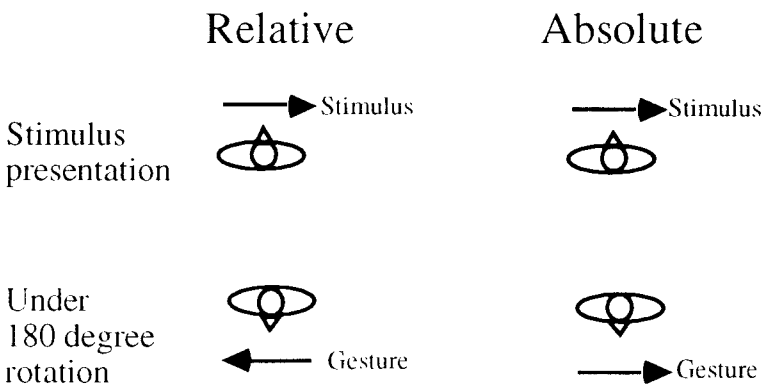


Figure 7.1: Gestural frames of reference: Relative and Absolute

7.3 Classification of gestures

De Ruiter devised a new classification system for gestures. Instead of only using the semiotic function of gestures as a basis for classification, gestures are classified by using both their function and their content as (orthogonal) dimensions. This method of classification pays attention not only to the shape and meaning, but also to the *communicative intention* of the gesture. The study is intended to be a theoretical contribution to the debate about the function of spontaneous gesture in its social context.

7.4 Arrernte handsigns

The Arrernte possess an auxiliary sign language with a codified gesture vocabulary of between 300 and 500 handsigns. It has a simplified syntax with reduced grammatical distinctions. An initial study by D. Wilkins focuses on the extreme polysemy of the handsigns in comparison to everyday lexemes. For instance, one handsign which is made by spreading the fingers (with thumb fully extended and abducted), holding the hand horizontally with the palm downwards and

the index finger projected somewhat downwards, and bringing this handshape into a trembling motion corresponds to five everyday words in Western Arrernte: *arrkekwetye* 'woman', *kwarre* 'big girl', *lernnge* 'sun', *kwerralye* 'the pleiades', and *arlte-le* 'in the daytime, during the day'. This is not a random collection of notions, and the structure of the network of semantic association can be represented as follows.

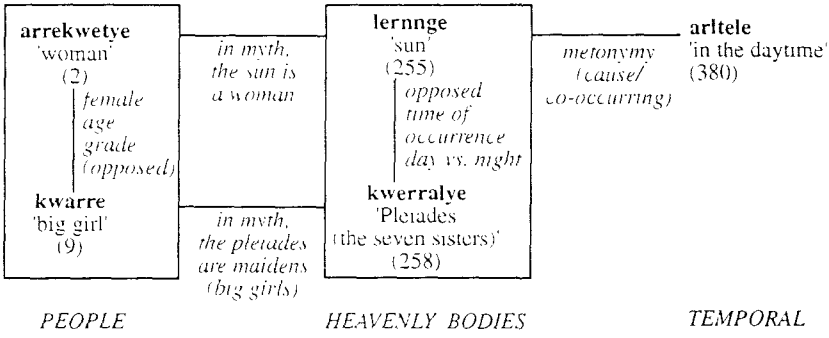


Figure 7.2: Semantic network of a polysemous Arrernte handsign

This network involves both quite universal and culture-specific structured parallelisms of concepts. Thus, the classic opposition between 'girl' and 'woman' is mirrored by the opposition of 'the sun' and 'the Pleiades' (both are celestial bodies, but maintain a daytime-nighttime opposition), and this parallelism and sense of structured oppositions is highlighted by the fact that in Arrernte myth 'the sun' is a 'grown woman' and 'the Pleiades' is a group of 'girls'. Thus, social/mythological knowledge and knowledge of day-to-day real world connections interact to support, and explain, complex networks of semantic association evidenced by such "hyperpolysemous" handsigns. Furthermore, semantic associations as evidenced by polysemy of handsigns are recapitulated in everyday language.

8. Sentence and Discourse Integration

This project aims to investigate the time course of integration processes above the word level. It deals with the role of lexical, syntactic, semantic and pragmatic information in constructing a representation of the sentence and discourse. The central question is: What information is available at different moments in the course of constructing the mental representation and how is this information exploited? The assumption is that different kinds of information are available at different moments and that therefore different integration processes take place at these moments. The studies deal with the role of semantic factors in the initial structuring of syntactic ambiguities, with the role of semantic and syntactic factors in pronoun assignment, with semantic and syntactic integration of lexical information in sentence processing, and with the role of world knowledge in discourse integration. In order to obtain converging evidence, both ERPs and reading time data, including eye movement registrations, are used in some of the experiments.

8.1 Semantic and syntactic integration processes during comprehension

This research is a collaborative effort between the Neurocognition of Language Processing project and the Sentence and Discourse Integration project. In two series of experiments, subjects read sentences that were initially structurally ambiguous. Reading times were measured. In separate experiments, but using exactly the same materials, ERPs were recorded. A start was made in collecting eye movement data on the same materials as well.

In the first series of experiments the initial structure assignment could be either an NP coordination within one clause, or an S coordination of a main clause followed by another main clause. According to the Minimal Attachment (MA) principle of the Garden Path model (e.g., Frazier, *Attention and Performance* 1987), subjects should initially prefer the conjoint NP reading over the conjoint S reading. This initial preference is thought to be impervious to semantic information. The

experiments examined both the presence of an initial structural preference, and the informational encapsulation of this first parse, by comparing measures to sentences with and without a semantic bias towards a non-MA reading. For example (the original materials are in Dutch):

(1) *without lexical bias*
The sheriff saw the cowboy and the indian noticed the horse in the bushes.

(2) *with lexical bias*
The helmsman repaired the mainsail and the skipper varnished the mast after the storm.

Structurally speaking, it is only at the second verb (i.e., noticed/varnished) that the sentences must be assigned a non-MA reading, but in terms of semantics the biasing sentence (2) clearly does not allow for a conjoint reading of the NPs when the second of the two nouns is encountered. For both kinds of sentences, the control condition consisted of exactly the same sentences but with a comma inserted after the first of the two consecutive NPs (i.e., cowboy, / mainsail,). This is a natural construction in Dutch, and unambiguously indicates that a new clause will follow.

In the reading time experiments, carried out by van R. Gompel, J. Hoeks (both U. Nijmegen), and W. Vonk, subjects read the sentences in a word-by-word moving window paradigm. The results show a longer reading time of the second verb in the condition without lexical bias, indicating that subjects have a preference for the NP-coordination. The observed longer reading time on the first word after this verb was interpreted tentatively as a spill-over effect. The results for the biased sentences do not show an effect on the second NP, in contrast to the effect on this NP in the unbiased sentences. Moreover, the biased sentences also show a longer reading time on the second verb. However, this difficulty seems to be less than in the unbiased condition, because the spill-over effect almost disappears. In both conditions there is an effect on the final word of the first clause, signalled by the presence of the comma, perhaps reflecting on-line 'wrap-up' processes at the constituent level during sentence processing.

The ERP experiments, carried out by A. Deckers, J. Groothusen, K. Remmerswaal, C. Brown, and P. Hagoort, were run in a RSVP paradigm. Preliminary analyses of the results for the non-biased sentences show a Syntactic Positive Shift (SPS) to the second verb, indicating that subjects had a preference for the MA-reading. The results for the biased sentences also show an SPS to the second verb, indicating that the semantic information did not completely override the presence of a structural preference. In addition, ERP effects are observed to the final word of the first clause, signalled by the presence of the comma, again perhaps reflecting "wrap-up" processes at the constituent level. These results were obtained when subjects were reading the words with a presentation rate of 4 per second. Preliminary results of a version with a presentation rate of one word per 686 ms do not fully replicate these results. In the lexical bias condition, an SPS effect is already seen to the second noun in the conjoint NP. However, no effects are obtained in the version without a bias. Further testing and analyses are therefore required to establish exactly under which conditions these effects can be obtained.

The second series of experiments tested the establishment of long distance dependencies in subject and object relative clauses. These experiments tested the claim of the Active Filler Strategy of Frazier that a filler is assigned to the first possible gap. In the absence of a semantic bias, this strategy predicts for Dutch a preference for a subject over an object relative reading before final disambiguating information comes in. The experiment exploited the fact that Dutch has SOV as its underlying word order. The following sentences are examples of the presented materials (in a literal translation of the original Dutch sentences; 1 and 2 indicate the postulated gap positions for, respectively, the subject and object relative reading):

(3) *subject relative clause*
In the middle of the ocean received the captain, who _1 the sailors _2 seen has, a bottle of rum

(4) *object relative clause*
In the middle of the ocean received the captain, who _1 the sailors _2 seen have, a bottle of rum

It is only by the time of reading the auxiliary (*has/have*) that the

relative clause gets its subject or objective relative reading.

The reading times in the word-by-word moving window paradigm show an effect on the finite auxiliary verb in the object relative clause in comparison to the subject relative clause. This effect obtained in the absence of a semantic bias of the main verb in these clauses, for instance *seen* in (3) and (4), indicating the preferred subject relative reading. The effect is also observed when positively semantically biased verbs, for instance *fired* in (3) or *served* in (4), precede the auxiliary instead of *seen*. A main effect of the bias of these verbs (positive bias vs negative bias) was obtained on the auxiliary, but not on the biasing verbs themselves. Whether these effects are delayed in this word-by-word paradigm is a question that may be answered by the eye movement experiment that is presently being conducted.

Analyses of the ERP data of the experiment in the RSVP version of 4 words per second, in the absence of a semantic bias, do not show a significant difference for the waveforms elicited by the auxiliaries in the subject and object relative clauses. However, with a presentation rate of 686 ms, an SPS is observed in the objective relative clause compared to its subjective relative counterpart. This result indicates that the parser detects the violation of the preferred subject relative reading. Further research is ongoing to establish the exact nature of this effect.

8.2 Semantic and syntactic integration of lexical information

A. Bolwiender and P. Zwitserlood (U. Münster), together with E. Drews and E. Neuwinger (both T.U. Braunschweig), continued their research on complex verbs. In a project sponsored by the Deutsche Forschungs-Gemeinschaft (DFG), the processing and representation of Dutch and German particle verbs was examined. Particle verbs are morphologically complex, consisting of a verb stem and a prefix. They have two important characteristics. First, unlike other prefixed verbs, prefix and verbal stem can be separated (e.g., *optillen* 'to lift'; *hij tilt de doos op* 'he lifts the box'). Second, particle verbs provide an opportunity to disentangle morphology from semantics. Although all particle verbs are morphologically complex, some are semantically non-compositional (e.g. *wegbrengen* 'to take away', and *ombrengen* 'to kill'). In the first part of the project research focussed on the specific

level of encoding of morphological structure, and on the relation between morphological and semantic complexity. Priming experiments in the visual modality were carried out, with particle verbs as primes, presented in their infinitive form (*wegbrengen, ombrengen*), and simple verbs as targets (*brengen*). Morphological priming was obtained for all particle verbs, but a semantic effect was also evident, modulating the amount of priming obtained (see Annual Report 1993).

A second aim of the project is to find out how particle verbs are processed in ongoing speech, focussing on their separability. The separability of verb stem and particle may lead to syntactic and/or semantic ambiguities, since it is often not clear whether a particle will follow when the finite verb form is heard (*Omdat hij woedend is, brengt Jan ...* (1) *zijn moeder naar huis* (2) *zijn moeder weg* (3) *zijn moeder om*). The question is whether there is lexical activation of the simple verb only, or of particle verb variants as well, after hearing the verb stem. Does the processing system "know" or "expect" that a verb stem may be followed at some point by a particle? So far, two crossmodal experiments have been carried out: one pilot experiment, with spoken simple verb primes and visually presented particle verb targets, and one context experiment. The results from the pilot experiment replicated the effects of the earlier visual experiments, with significant morphological priming for semantically transparent and opaque particle verbs, and again more facilitation was obtained for semantically transparent verbs.

In the context experiment, finite verb forms were auditorily presented after a neutral clause or adjunct, effectively presenting the verb stem before the particle (*tijdens de derde aflevering van de miniserie, brengt Max...*). Presentation was stopped after the subject noun, at which point one of three targets were presented visually for lexical decision: a simple verb, a semantically transparent particle verb or a semantically opaque particle verb (e.g., *brengen - wegbrengen - ombrengen*). Relative to a control condition, responses to all three targets were facilitated, but no interactions were found with semantic transparency. This was interpreted as evidence for lexical ambiguity and multiple activation. When the lexical system encounters a verb stem in an ongoing sentence, it makes available all possible continuations of that verb stem (particle verbs as well as simple verbs).

8.3 Pragmatic effects on parsing

Do pragmatic factors affect on-line parsing? Although there is ample evidence supporting independent initial syntactic analysis, the issue is not settled yet. G. Flores d'Arcais has looked at the influence of pragmatic factors, as contrasted with purely structural constraints, in the attachment of verbs to NP in simple sentences in language comprehension of children. He carried out a number of experiments, both with Dutch material and Dutch subjects, and with Italian material and Italian subjects, using recording of eye fixations, paced word by word or segment by segment reading of a sentence, and speeded judgment of grammaticality. Consider the following Italian sentences:

(1) Paolo vide Maria camminando sulla spiaggia. (Paul saw Mary walking on the beach.)

(2) Paolo vide Maria camminare sulla spiaggia. (Paul saw Mary walk (inf) on the beach.)

(3) Paolo vide Maria mentre camminava sulla spiaggia. (Paul saw Mary while # walked on the beach.)

In Italian *camminando* in (1) can only refer to Paolo, not to Maria. In (2), the infinite form of walk can only apply to Maria. Finally, (3) is ambiguous, for *walking* can be assigned both to Paolo and to Maria. A number of results have been obtained so far. First, children up to 7-8 years tend to attribute *walking* in (1) to Mary and not to Paul. Second, they also tend to prefer the second NP in sentences like (3). Adults take longer to correctly assign *walk* to Maria in (2) than to assign *walking* to Paolo in (1). Third, some interesting pragmatic effects have been found. Consider the following sentence:

(4) Il pilota vide Maria guidare l'automobile sul lungomare (The pilot saw Mary drive (inf) the car on the road along the sea.)

Children consistently incorrectly assign 'drive' in (4) to the pilot. Adults make some errors, have longer reading times and, as reflected in eye movement recording, check back and forth between the two NPs longer than with sentences such as (2). Work in progress is trying to look

closely at what moment during processing the pragmatic effects become evident.

8.4 Pronoun resolution and pragmatic knowledge

Flores d'Arcais has been working on processing principles regulating pronominal assignment in sentences with two NPs. The language processor can assign the pronoun to the first NP because of "first mention" or "primacy" of the agent, or to the second NP because of "clause recency" or "contiguity". In both cases, these principles are based on the internal structure of the sentence. However, assignment can be governed by semantic or pragmatic principles. Consider the following pairs of sentences:

(1) The doctor examines the patient. He wears a white coat.

(2) The driver was talking to the passenger. At the intersection, he had to brake the car to avoid an accident.

(3) The bell boy was accompanying the new guest to the room. He was carrying a light suitcase.

In (1), pragmatic factors should tend to favour pronominal assignment to the first NP. Pragmatic principles can be expected to have a more or less strong action: In (2), pronominal reference seems to favor the first NP *the driver* in (3), this tendency is likely to be less strong. The study was carried out with Italian materials and Italian children (5 to 9 years) and adults, and looked at the differential attribution of pronominal reference with sentences characterized by different degrees of "pragmatic strength", as indexed by ratings made by a group of judges. The tasks used were question answering and verification of statements about the "actor" in the sentence. For example, the subject was given a sentence such as 'The guest is carrying the suitcase' following sentence (3), and had to decide as fast as possible whether it was a true or false conclusion of sentence (3). The results indicated a differential influence of structural and pragmatic factors in adults and children. Children seem much more strongly dependent on pragmatic factors. Structural factors become gradually dominant with increasing age. Both

in adults and in older children, weak pragmatic constraints seem to favor a clear dependency on structural factors for the attribution of pronominal reference. Strong pragmatic constraints tend to prevail over structural ones. Interestingly, the decision latencies are characterized by a u-shaped function of the degree of pragmatic strength. With strong pragmatic constraints the decision is rather fast, the response latencies increase with the decrease of the strength of the constraint, and finally the latencies become again shorter with much weaker or neutral pragmatic constraints, when structural factors tend to become dominant or to be the only ones which are guiding the attribution.

8.5 Different functions of alternative anaphoric expressions: Demonstrative NPs

The function of anaphoric expressions is to establish referential coherence in a discourse. But, if all there is is identification, why are there two different expressions, as in sequence (1):

(1) The sparrow is protected from temperatures below freezing by its plumage. Therefore the/this bird winters in The Netherlands without problems.

The use of anaphoric expressions cannot be accounted for purely on the basis of their identificational function, they must have other functions in the discourse. In work sponsored by ESPRIT in the Dandelion project, Vonk, in collaboration with L. Hustinx (U. Nijmegen), investigated different pragmatic functions of some expressions that are propositionally equivalent. The experimental work in 1994 concentrated on the function of demonstrative anaphors. It is claimed that the use of a demonstrative determiner changes the representation of the underlying discourse referent. For example, when the demonstrative NP is a superordinate of the referent, the discourse referent is classified within its natural class: In the example, a contrast is made with other birds.

Vonk and Hustinx set out to test this claim in several off-line and on-line experiments. In one experiment, subjects were given a text fragment containing a sentence with a demonstrative NP or a definite NP that was a superordinate, that referred to a referent in the preceding sentence, as in (1). The subjects had to produce a continuation sentence. If the definite NP has just an identificational function and the

demonstrative on top of that a classifying function so as to activate other members of the class, one would predict that subjects mention in their continuation sentence other birds more frequently after the sentence with the demonstrative NP anaphor than after the sentence with the definite NP anaphor. That was indeed the case. If a demonstrative NP anticipates the introduction of a different member of the same class, sentences mentioning another member of the class (for instance, *swallow*) should be judged more continuous when it is preceded by a sentence containing a demonstrative NP anaphor than when it is preceded by a definite NP anaphor. A rating experiment did not confirm this prediction. A more sensitive, on-line, measure appeared to be reading times. Again, a sentence in a text containing either a demonstrative NP superordinate or an definite NP superordinate was followed by a continuation sentence containing a new topic, i.e., a different member of the same class as the NP superordinate anaphor referred to. The integration of this continuation sentence should be easier after the sentence with the demonstrative NP anaphor than after the sentence with the definite NP anaphor. On the other hand, if the demonstrative activates other members of the same class as potential topics, then the sentences with demonstrative NP anaphor should require more processing time than sentences with the definite NP anaphor. Indeed, the reading data do show a significant interaction between the two kinds of determiners and the two sentences.

To measure the activation of class members more directly, the name of a class member was presented after the sentence with the referring demonstrative or with the referring definite NP in a lexical decision experiment. The experiment showed that the demonstrative superordinate anaphor modifies the discourse referent representation by activating the class (or part of it) of which the discourse referent is a member.

Closely related to the experimental work on demonstratives is the work by L. Noordman (U. Tilburg), who spent some months at the Institute. The work was done in collaboration with A. Maes (also U. Tilburg). They investigated the function of demonstrative nominal anaphors in a large Dutch corpus collected by Maes. On the basis of the analysis of this corpus, Maes and Noordman claim that the demonstrative determiner cannot be simply regarded as a marked device enabling readers to give better or quicker access to the intended discourse

referent. The demonstrative determiner signals a predicating reading of the NP involved. It enhances the activation of contextually relevant information regarding the discourse referent. The effect is that the representation of the underlying discourse referent is modified. Maes and Noordman distinguish between three types of modification. First, a discourse referent underlying a demonstrative nominal anaphor can be classified with respect to its natural class. Second, it can be contextualised. Third, additional information can be attributed to the referent. The particular type of modification depends on the formal-lexical relationship between the anaphor and its antecedent. For example, an anaphor which is a superordinate of its antecedent (as in: "Clinton...This president") activates the class members of the discourse referent. This result from the corpus analysis fits nicely with the experimental work by Vonk and Hustinx reported above.

8.6 Inference processes and discourse integration

Earlier experiments on causal inferences by Vonk in collaboration with Noordman (U. Tilburg) demonstrated that the availability of the information is a variable controlling the inference processes (Annual Report 1990). Inferences are made by experts, but not by non-experts when reading a text in the domain of the expert's expertise.

In order to generalize these results, Vonk and Noordman, in collaboration with R. Cozijn (U. Tilburg), conducted experiments with texts on topics which are familiar to all readers but in which the causal relations were either highly plausible or less plausible. In order to investigate the interaction between the reader's knowledge and the presence of linguistic signals, the causal relations were either marked by the conjunction *because* or unmarked. The presence of a causal conjunction decreased the reading times for the causal relations. This was found both for highly plausible and less plausible causal relations. Probe recognition times gave evidence for an inference for the highly plausible relations, as did verification latencies. The reading times, however, did not. The results suggest that the conjunction *because* may have several functions: It may facilitate the integration process, thus speeding up reading; it may induce an inference, thus slowing down reading. The latter effect is supposed to be manifest at the end of the

sentence. Experiments are in progress to disentangle these effects by using eye movement registrations.

9. Neurocognition of Language Processing

This year was the first full year of the various subprojects within the project, which is sponsored by the Netherlands Organization for Scientific Research (NWO). In this year, a series of new experiments was initiated. In addition, major time investments of the project's scientific programmer (R. de Bruin) were made to adapt the ERP analysis software to a UNIX environment, and to adapt and develop analysis and graphical software for PET data. To support the patient infrastructure for the aphasia research, a major ongoing effort has been the updating and extension of the subject pool with aphasic patients and patients with right hemisphere lesions. This work is the main responsibility of the project's language and speech pathologist A. Nevejan.

9.1 The neural architecture of language processing: A PET and fMRI study on reading and naming German words and nonwords

In 1994, P. Indefrey, C. Brown, and P. Hagoort in collaboration with R. Seitz (Heinrich-Heine-Universität, Düsseldorf) and H. Herzog (Institute of Medicine, Forschungsanlage Jülich) completed a PET-experiment on visual lexical processing. The PET procedures and analyses used in Jülich and Düsseldorf were validated by independently analyzing the data with the Statistical Parameter Mapping (SPM) analysis package from the Hammersmith group, in collaboration with I. Law and C. Svarer at the University Hospital, Copenhagen. The two procedures resulted in largely the same activation areas. For those stimulation conditions that replicated conditions of a series of PET-studies by Petersen et al. (*Nature* 1988; *Science* 1990), the results were in partial agreement with the Petersen et al. data. Activation was seen in both medial and lateral extrastriate areas during word reading. However, in contrast to the Petersen et al. studies, we found bilateral instead of only left medial extrastriate activation during the processing

of visually presented words and legal nonwords (see PET-Figure, Images 1 and 2). In addition, activation of the lateral occipito-temporal (fusiform) gyrus, predominantly on the right side, and temporal activation were found for both words and nonwords (see PET-Figure, Images 3 and 4). As an extension of the Petersen et al. studies, the pronunciation of nonwords was included as an additional task. In contrast to pronouncing words, pronouncing nonwords cannot be performed by retrieving a phonological code via access to the visual input lexicon. Instead, it requires sublexical grapheme-to-phoneme conversion. Subtracting the pronunciation of words from the pronunciation of nonwords resulted in stronger activation of an area in the left posterior inferior frontal gyrus (Broca's area, see PET-Figure, Image 5). This area presumably is involved in assembling a phonological code and/or grapheme-to-phoneme conversion processes.

To exploit the anatomical information for individual brains that is provided by functional Magnetic Resonance Imaging (fMRI), Indefrey has adapted the experimental material of the lexical processing study for an fMRI pilot experiment, which was carried out in collaboration with J. Frahm and A. Kleinschmidt at the Max-Planck-Institut für Biophysikalische Chemie in Göttingen. The data of this experiment are currently being analyzed.

A new PET experiment on sentence processing has been designed. This experiment aims at finding localized areas of the brain that subserve the ability to construct a syntactic representation for an utterance. The materials for this experiment have been constructed and pre-tested. The first PET data will be acquired soon.

9.2 Semantic and syntactic integration processes during comprehension: ERPs and parsing

In 1994, the establishment of the Syntactic Positive Shift (SPS) as an ERP response to the violation of syntactic preferences (see Annual Reports 1992, 1993) has been followed up by A. Deckers, J. Groothusen, K. Remmerswaal, C. Brown, and Hagoort in a new series of studies. These studies exploited the existence of ERP responses that are differentially sensitive to semantic (N400) and syntactic processing (SPS), to investigate the nature of parsing operations in human sentence processing. These experiments are a collaborative effort between the Neurocognition project and the MPI project on sentence and discourse

Extrastriate activation areas for silent reading of words (image 1) and legal nonwords (image 2). Middle and superior occipital gyri drawn in from the Computerized Brain Atlas (CBA) database.

Frontal and fusiform gyrus activation areas for silent reading of words (image 3) and nonwords (image 4). Lateral occipito-temporal gyrus drawn in from the CBA database.

Image 5: Additional activation of Broca's area for pronunciation of nonwords as compared to words. Opercular part of inferior frontal gyrus drawn in from the CBA database.

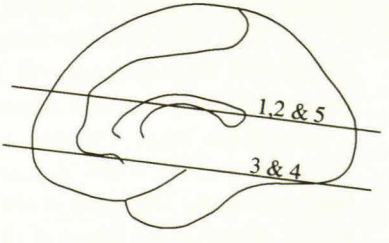


Image 6: Slice levels of images 1-5.

integration (W. Vonk). That is, next to ERPs, exactly the same materials are used to collect reading time and eye movement data, in an attempt to integrate evidence from different methodologies into an overall account of parsing operations.

In two experiments, ERPs were recorded whilst subjects read sentences that were initially structurally ambiguous. In the first experiment, the initial structural assignment could be either a conjoint reading of two successive NPs within one clause, or a main clause followed by a sentential complement. The second experiment tested the establishment of long distance dependencies in subject and object relative clauses, more precisely the preference for a subject over an object relative reading before disambiguating information comes in. For purposes of presentation within this Annual Report, the ERP data on parsing will be presented in the section on the "Sentence and Discourse Integration" project.

9.3 Lexical access in speech production: The Lateralized Readiness Potential as an index of semantic and phonological activation during speech production

M. van Turennout, Hagoort, and W. Levelt initiated research examining the possibilities of using the ERP technique in the study of lexical access in speech production. A new experimental paradigm was created in which the Lateralized Readiness Potential (LRP) was used to assess the time course of the semantic and phonological processing stages during lexical access in speech production.

The LRP is a movement-related brain potential, reflecting the differential activation of, for instance, response hands. The LRP is assumed to be a real-time measure of selective response preparation. If a differential hand response has to be made in response to a given stimulus, an LRP starts to develop as soon as the preparation for the response starts. The LRP is sensitive to response preparation based on partial stimulus information. It can therefore be used to estimate the moment in time at which separate stimulus dimensions (e.g., size, location) become available.

In the experiment, subjects were presented with pictures, and they were instructed to name these pictures. In fifty percent of the trials a frame appeared around the picture at 150 ms after picture onset. On

appearance of the frame, a dual decision task had to be performed preceding picture naming. Subjects had to decide if the picture represented an animal or an object (semantic decision), and if the word-final phoneme of the picture name was an /n/ or an /s/ (phonological decision).

In one experimental condition, the phonological decision determined whether or not a pushbutton response should be given (go-nogo); the semantic decison determined the response hand (e.g., left for objects, right for animals). In this condition an LRP emerged not only for the go, but also for the nogo trials. Moreover, the LRPs for go and nogo trials had the same temporal onset (see Figure 9.2a). Since the LRP represents the preparation of the correct response hand, this result indicates that semantic information is available and used for response preparation before phonological information is available for making the go-nogo distinction. At a later moment in time the nogo-

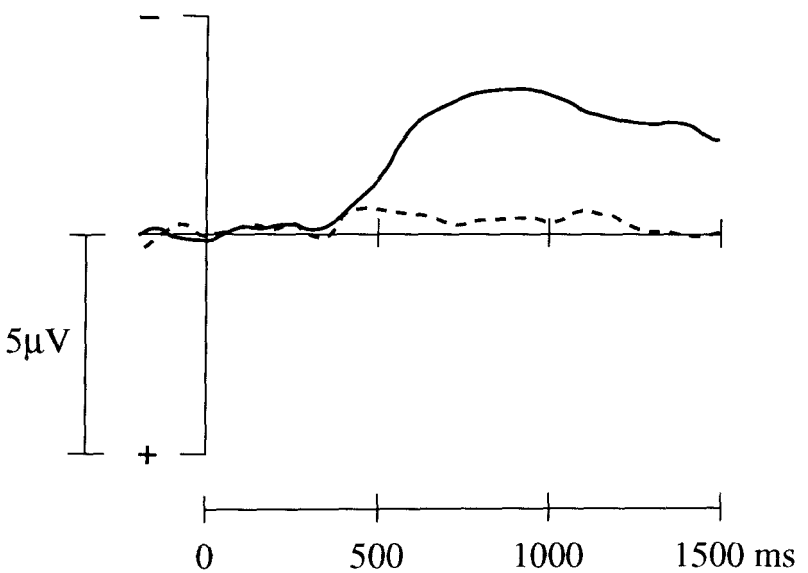


Figure 9.2a: LRP for go trials (continuous line) and nogo trials (broken line) Phonological go-nogo decision, semantic left-right response.

waveform started to diverge from the go-waveform. The LRP kept on developing for the go trials but went down to the baseline for the nogo trials. At this point in time, sufficient phonological information is available to complete the go-nogo decision.

In another experimental condition the task-instruction was reversed: The word-final phoneme determined the left-right decision, and animateness determined the go-nogo decision. In this condition, the moment in time at which phonological information becomes available determines whether and when an LRP starts to develop. The results showed that in this condition an LRP developed only for the go trials, but not for the nogo trials (see Figure 9.2b).

Together, the results of this experiment indicate that semantic activation precedes phonological activation during lexical access in speech production. This experiment is the first demonstration in the literature that the LRP-go/nogo paradigm provides a sensitive measure

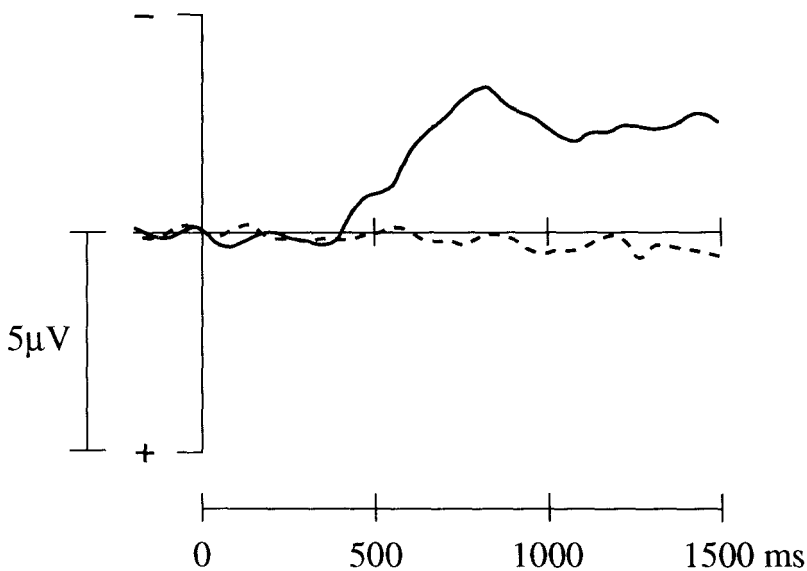


Figure 9.2b: LRP for go trials (continuous line) and nogo trials (broken line) Semantic go-nogo decision, phonological left-right response.

of the time-course of semantic and phonological activation during picture naming. Currently, experiments are being prepared in which this paradigm is used to investigate more specific time-course predictions with respect to the two stages.

9.4 ERP studies on language disorders

9.4.1 The time course of lexical integration in aphasic patients

T. Swaab, C. Brown, and Hagoort have completed a research program on spoken language comprehension deficits in aphasia. One of the central goals of this research was to test the claim that comprehension deficits in aphasia result from changes in the temporal dynamics underlying lexical integration processes. The dependent variable was the N400, which is known to be a sensitive measure of lexical integration processes.

In the crucial experiment, the time course of resolving lexical ambiguity on the basis of sentential context information was used to investigate lexical integration in aphasic patients. In the experiment, 12 Broca's aphasics and 12 normal controls were presented with sentences in three context conditions, followed by the same target word. This is illustrated in the following example (sentence-final word and targets are in capitals):

Concordant:
The tall man planted the tree on the BANK. SLOPE
Discordant:
The poor man made a call to the BANK. SLOPE
Unrelated:
The busy man gave his ticket to the BOY. SLOPE

In the concordant condition, the sentence biased the meaning of a sentence-final ambiguous word that was related to the target. In the discordant condition, the sentence context biased the alternative meaning of the sentence-final ambiguity. In the unrelated condition, the sentence ended in an unambiguous noun, that was unrelated to the target. The task of the subjects was to listen attentively to the input. Importantly, no additional task demands were imposed.

In normal subjects, the overall picture emerging from the literature on the resolution of lexical ambiguity is the following. At

least initially, independent of contextual bias, the different meanings of ambiguous words are activated to a greater or lesser extent. Next, the contextually appropriate meaning is integrated and the inappropriate one deactivated. Ambiguity resolution is therefore a direct function of the integration of the contextually appropriate meaning. To investigate the time course of this process, the target words were presented either 100 ms or 1250 ms after the offset of the sentence-final word. The activational status of the target-related meaning of the ambiguous sentence-final words was inferred from the amplitude of the N400 to the targets. Successful selection of the appropriate meaning would predict a reduction of the N400-amplitude to targets in the concordant condition relative to the discordant and unrelated conditions. No differences in N400-amplitude should be observed in the discordant relative to the unrelated condition. For the normal controls, this pattern of results was observed at both intervals between sentence and target.

In contrast to normal controls, the aphasic patients showed the normal pattern of results only at the 1250 ms interval between sentence and target. At the 100 ms interval, however, the N400-amplitude was also reduced in the discordant condition relative to the unrelated baseline. Thus, the aphasics showed a delay in the integration/selection of the contextually appropriate reading of the ambiguous words.

The general conclusion from the experiment described here, and from two other ERP-experiments investigating lexical-semantic and sentential processing in aphasia (see Annual Report 1993), is that comprehension deficits in aphasia might indeed result from changes in the temporal dynamics underlying language processing. This probably results from a delay in the process of integrating lexical information into the context of a preceding word or sentence.

9.4.2 The ERP characteristics of open and closed class words in normals and agrammatic patients

M. ter Keurs started research on this part of the Neurocognition project at the end of 1993. Part of her work is done at the Neurology Department of the University of Nijmegen, where 32-channel EEG recordings are performed with normal and aphasic subjects, and where, in collaboration with P. Praamstra and D. Stegeman (both U. Nijmegen), possibilities for characterizing the neural generators underlying the scalp-recorded activity are explored.

A first study in this project examines the ERP characteristics

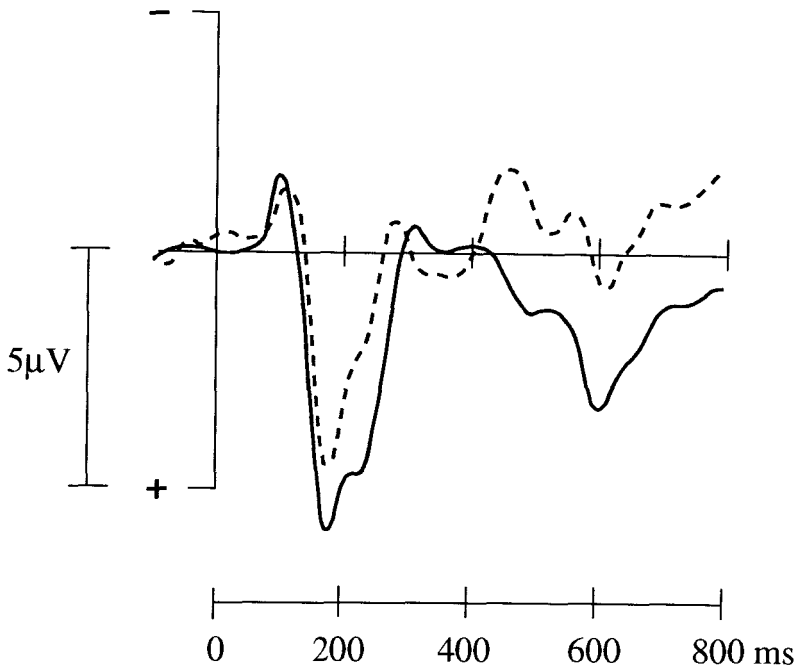


Figure 9.3: ERPs to open class words (continuous line) and to closed class words (broken line) at left frontal electrode location.

of open class words (e.g., nouns, verbs, adjectives) and closed class words (e.g., articles, auxiliaries) in normals and in agrammatic aphasics. Its goal is twofold: first, to determine the ERP signatures of (different types of) open and closed class words, since very little electrophysiological evidence is available on the processing of distinct word classes; second, to investigate whether comprehension deficits of agrammatic patients are related to an impairment in exploiting the syntactic function of closed class words. This is done by comparing the ERP responses to closed and open class words of agrammatics with those of their elderly controls.

The experiment consists of the reading of a short story, which is presented word by word on the centre of a screen, at a relatively slow rate (SOA = 800 ms). The story is contructed such that it allows

for a systematic comparison of ERPs elicited by different types of closed class and open class words. So far, 25 young students, 6 agrammatic patients, 6 older control subjects, and 1 right-hemisphere patient with normal comprehension have been tested.

Preliminary analyses of the results for the young students show that closed class and open class words each elicit a clearly distinct ERP pattern (see Figure 9.3). The closed class words elicit an early negativity between 250-300 ms (N280), that is broadly distributed over both hemispheres, but most prominent in left frontal areas. Between 300-450 ms open class words elicit a larger negativity (the N400) than closed class words. However, from 450 ms onwards, the closed class words elicit a larger negativity than the open class words. The latter pattern is also broadly distributed over both hemispheres. These results are consistent with the scarce evidence reported in the literature, and suggest differential processing of grammatical and lexical information. Preliminary results of 3 agrammatic patients suggest divergence of ERP responses to open and closed class words only in the later parts of the waveform, but not in the earlier part.

9.4.3 Semantic and syntactic ERP effects in agrammatic comprehenders

M. Wassenaar, C. Brown and Hagoort designed and implemented an experiment on on-line sentence-level syntactic and semantic processing in agrammatic patients. This experiment uses the SPS (Syntactic Positive Shift) and the N400 as diagnostic tools with which to investigate comprehension at sentence level processing. The SPS is a positive polarity brain potential that starts at about 500 ms following relevant stimulation, and is sensitive to on-line syntactic processing. In contrast, the N400 is a negative component that is sensitive to semantic integration processes.

Sentence materials were created to answer the following questions: (1) Do agrammatic comprehenders show more severe problems with syntactic than with semantic integration? (2) Do agrammatic comprehenders show more problems with syntactic integration across phrasal boundaries than within the level of one phrase? (3) Do agrammatic comprehenders show more problems with syntactic integration in syntactically complex sentences than in more simple ones?

In addition, an off-line sentence picture matching test was

developed for patient selection. This test established whether the Broca's aphasics suffer from agrammatic comprehension by evaluating their syntactic sentence comprehension. The off-line test is a Dutch adaptation of a German syntax test developed by Huber et al. (*Neurolinguistik* 1993). During 1994, the Dutch version was constructed. This version consists of 5 sentence types, namely: (1) active, semantically irreversible sentences, (2) active, semantically reversible sentences, (3) simple passive sentences, (4) sentences with a relative clause containing a prepositional phrase, and (5) embedded passive sentences. All agrammatic aphasics that we tested performed substantially worse than the elderly normal control subjects. In particular, the syntactically more complex sentences (3-5) resulted in lower scores among the agrammatic Broca's aphasics.

In the ERP experiment, the selected agrammatics and their elderly controls were presented with spoken sentences. The sentences contained violations of phrase structure rules (transpositions of adverbs and adjectives in Adv-Adj-N sequences), semantic violations (violations of selectional restrictions), and violations of subject-verb agreement (both in a simple and complex constituent structure). To date, 10 elderly controls and 7 agrammatic patients have participated in the experiment. So far, only the data of the elderly control subjects have been analyzed. The preliminary results for these elderly controls show an SPS-effect in response to violations of phrase structure rules and to violations of subject-verb agreement. The latter effect is seen both in simple and complex constituent structures. Testing of additional subjects (elderly controls and agrammatic patients) is currently being carried out.

10. The Structure of Learner Varieties

This project involves the co-operation of several European research centres and continues work in the European Science Foundation's project "Second Language Acquisition by Adult Immigrants" (see previous Annual Reports). The languages studied are mainly Dutch, English, French, German, and Italian. The project has begun to study two crucial aspects of learner varieties more closely: (a) scope phenomena, in particular focus particles and negation, and (b) referential movement, that is, the way in which information from various cognitive domains such as time, space, and object specification is introduced and maintained in a coherent text. The project will primarily deal with second language acquisition. But connected to the scope sub-project, there is also a project on quantification and scope in first language acquisition, as well as some work on referential movement in first language acquisition. We shall first report on this sub-project and then on referential movement in both first and second language acquisition. Work on scope in second language acquisition will start in 1995.

10.1 Quantification and scope in first language acquisition

K. Drozd, in cooperation with W. Klein and J. Weissenborn, investigated three topics in the acquisition of Dutch and English determiner quantification systems: (1) the acquisition of universal and cardinal quantification, (2) the acquisition of discourse negation, and (3) the acquisition of simple determiners.

10.1.1 Universal and cardinal quantification

Two pilot studies were carried out, both in cooperation with I. Kraemer: a Universal Quantification experiment, and a Cardinal Determiner experiment. The first experiment investigated whether Dutch and German children, like American children, overwhelmingly prefer to construct a distributive, one-to-one ("symmetrical") interpretation for transitive sentences with universally quantified determiner phrases, e.g. where *Ieder meisje houdt een ballon vast*

'Every girl holds on to a balloon' is misinterpreted as meaning that each balloon is held by a girl in addition to its ordinary meaning. After a pilot study revealed a significant preference by Dutch children for symmetry, 84 Dutch children and 39 Dutch adults were presented with a picture verification task similar to those used in previous studies to elicit symmetrical interpretations. Our hypothesis was that Dutch children's preference for a symmetrical interpretation of universally quantified sentences would not be affected by (1) linear order of quantified and indefinite determiner phrases, (2) picture bias (collective, distributive), (3) mean age (4;2, 5;10), and (4) response type (yes, no). However, we predicted that the children's preference would be affected by (5) question type (inverted, uninverted with tag), as suggested by previous experimental results.

Children performed significantly worse than adults across all independent variables and levels. Although adult controls did not show any preference for symmetry when this symmetry was ungrammatical (as expected), 36% of the children consistently preferred a symmetrical response across conditions. For example, in contrast to adults, these children claimed that subject quantified sentences like *Zit iedere jongen op een dolfijn?* 'Is every boy sitting on a dolphin?' was wrong when presented with a picture in which every boy is riding one of two dolphins (Condition 3, collective bias) and pointed to the fact that no boy was riding the second dolphin as evidence.

Variables (1)-(4) did not produce significant main effects within and between child groups, replicating results of previous research. However, significant age/picture bias and age/response interactions were observed. The source of these results seems to be that older children were better able to give a correct negative answer to pictures with distributive biasing than younger children. This result may reflect older children's adult-like preference to assign unique reference to indefinite subjects in quantified contexts rather than development in children's ability to process universal quantification.

This can be seen by comparing children's answers to questions with indefinite subjects on pictures with distributive and collective biases. When asked the awkward question *Raakt een kind iedere olifant aan?* 'Is a child touching each elephant?' when presented with a picture including three children each touching a different elephant (Condition 2, distributive bias), only older children preferred to answer *nee*, like adults. This suggests that adults and older children require the subject

een kind to have unique reference. However, while adults also assign a unique referent to the indefinite subject in *Houdt een meisje iedere ballon vast?* 'Is a girl holding on to each balloon?' when presented with a picture of three girls of which one is holding three balloons (Condition 1, collective bias) children do not. Both younger and older children tended to respond *nee* rather than *ja* and referred to the fact that the remaining two girls in the picture were not holding balloons as evidence for their response.

One proposed syntactic explanation for children's preference for symmetry, according to T. Roeper and J. deVilliers, is that children have an incomplete determiner phrase (DP) syntax which prohibits them from consistently fixing the domain of quantification to the denotation of the common noun phrase argument of the determiner, as expected if children interpreted determiner quantifiers as *conservative* functions like adults. Thus, in the absence of a clear syntactic analysis, children may misanalyze determiner quantifiers like *iedere* as sentential adverbs of quantification, *in iedere geval*, predicting the symmetrical interpretation. Specifically, children should misanalyze not only "strong" quantifiers like *iedere* as *iedere keer/in iedere geval*, but "weak" determiner quantifiers like the cardinal *twee* '2' as *twee keer* 'two times/twice'.

The Cardinal Determiner experiment tests this "quantifier-as-adverb" hypothesis using a Truth Value Judgement Task. After a series of pretests, 93 Dutch children and 25 Dutch adults were told 8 stories (1 warm-up, 2 *twee* and 2 *iedere* test stories, 3 fillers) using pictures in which particular adverbially quantified propositions were clearly verifiable, e.g., *Een jongen heeft twee keer een hek geverfd* 'A boy painted a fence two times' is true of a story in which one boy, Gijs, paints the same fence on two different occasions. Subjects were then asked questions about the stories which were not true of the stories. These questions included the corresponding determiners. e.g. *Twee jongen hebben een hek geverfd. Heb ik dat goed geraden?* 'Two boys painted a fence. Did I get that right?'. Children were expected to respond in the negative if they understood the test sentences as determiner quantified and to respond affirmatively if they did not.

Children's performance on the *iedere* conditions was significantly worse than their performance on the *twee* conditions, which closely approximated adult behavior on the *twee* conditions. Moreover, younger children performed significantly worse than older

children only on the *iedere* conditions.

These results strongly suggest that the quantifier-as-adverb hypothesis is too strong. Children may only have difficulty processing "strong" universal quantifiers. The sources of this difficulty may be the processing of universal quantification alone, distributivity alone, or both.

10.1.2 Discourse negation in child English

Most theories of the acquisition of negation have been syntax-oriented. The goal of the Discourse Negation Project (following up earlier work by Drozd) is to compile a cross-linguistic coded database consisting of young children's elliptical negative utterances in discourse and to explore ways in which the data can be modelled under recent dynamic approaches to semantic description.

All of the syntactic uses of *no* were collected and coded from the transcripts of the English corpus of the CHILDES Data Base wich were available to us (about 110 children), with a core corpus consisting of the longitudinal transcripts of 10 children, ages 2;2-3;4 (115,950 utterances, 451 tokens). The descriptive and theoretical analyses of the data argue that even young children can construct sophisticated grammatical interpretations for negative utterances, though the majority of these utterances are syntactically simple. The majority of the *no* data (67%) consists of grammatical and felicitous uses of DP negation to express a variety of functions like nonexistence, *No more humming* 'There is no more humming', rejection, *No egg shell* 'I don't want the egg shell', and metalinguistic objection, *No way!*. In earlier work, Drozd argued that the more notoriously ungrammatical presentential nonanaphoric negatives like Peter's *No that's a cake*, actually reflect children's early competence in using metalinguistic sentence negation, e.g., *Don't say "that's a cake"!*:

Peter (2;3)	Mother:	That's a cake. We're gonna have it for dinner.
	Peter:	No that's a cake!

This is in contrast to standard analyses which assume these negatives reflect an intermediate non-adult-like stage in children's development of internal descriptive, rather than metalinguistic, sentence negation.

10.1.3 Simple determiners in Dutch

Drozd and N. Hugoosgift conducted a study of the simple determiners *het/'t* (both neuter, definite), *een/'n* (indefinite), and *de* (non-neuter definite) in the spontaneous speech of two Dutch children, Hein (2;4-3;1) and Thomas (2;4-2;11) using CHILDES transcripts (28,277 total utterances, 1609 determiner tokens). Their results corroborate previous findings which suggest that when children use these simple determiners, they use them correctly. Both children used these determiners correctly 93.7% and 73.8% of the time, respectively. The slightly lower percentage observed, compared to the English findings, can be attributed to the added complexity of the Dutch determiner system – in that the Dutch children also have to learn gender distinctions. Hugoosgift's findings also supported previous proposals that children are sensitive to the restrictiveness and frequency of determiner use in the input. Of all determiners used, the Dutch children produced *de* most often (49%), reflecting the use of *de* three times as often as determiner *het* or *'t*. In addition, most incorrect uses of these determiners were uses of *de* incorrectly with nouns of the wrong gender, perhaps reflecting the fact that *de* is much less restricted than *het/'t* in Dutch. This research provides strong cross-linguistic support for the claim that even young children can use simple quantifiers productively.

10.2 Referential movement in first and second language acquisition

10.2.1 Motion and location in narrative discourse: a cross-linguistic study

H. Hendriks continued her research in the context of the project "Time and space in first language acquisition" supported by the Deutsche Forschungsgemeinschaft and in collaboration with M. Hickmann (U. Paris V, CNRS), F. Roland (U. Nantes), J. Liang (U. Leiden) and B. Löbach. The last part of this research focusses on children's acquisition of linguistic devices for the expression of motion and location both within and across utterances in English, French, German, and Chinese, with particular attention to universal vs. language-specific factors affecting the course of development. The database consists of narratives elicited from adults and children (between 4 and 10 years) on the basis

of picture sequences presented in a situation of no mutual knowledge.

Various devices are necessary across languages to represent motion and location, e.g., motion and posture verbs, prepositions, adverbials, particles, case markings. In addition, languages vary in how different components of motion events are encoded in the clause. Thus, following Talmy's typology, English, German, and Chinese are Manner-type and Satellite-framed languages, while French is a Path-type and Verb-framed language.

Within utterances, main differences were found in the dynamic motion predicates across languages which follow the pattern of the adult language from 4 years on. English and German motion predicates frequently combine different pieces of spatial information productively and compactly by means of both verb root and satellites. French motion predicates are less varied and encode information mainly in the verb root only.

The patterns of children's marking of the status of spatial information are quite similar across languages. There is an increase with age in: (1) the explicit marking of grounds; (2) the setting of spatial frames; (3) the use of appropriate markings of newness. In addition, both explicitness and information status are related to predicate types in all IE languages, i.e., static and dynamic motion predicates with general locations differ from motion predicates with changes of location in that they contain: (1) more explicit grounds; (2) more first mentions of grounds; (3) more appropriate introductions of grounds.

Static predicates, however, have a special role for young French children, a result which is compatible with previous results concerning Spanish. It partly reflects their frequent use of presentative devices to introduce and reintroduce referents, as also shown by earlier analyses of the same narratives on the introduction of the animate protagonists. These results show that the mastery of devices that contribute simultaneously to the sentence and discourse levels are a central part of children's language acquisition, regardless of the language being acquired.

Hendriks extended her research of both temporality and motion/location in narrative discourse to a comparison of first and second language acquisition. The above narrative database collected with children is compared to a database collected with Chinese adults of acquiring either German or French (in 4 different proficiency levels).

Data collection, transcription and coding were begun, using an identical set of materials, procedures, and coding principles as in the above project.

10.2.2 The acquisition of temporality in adult learners of Italian

While a visitor at the Institute, A. Ramat (U. Pavia) continued her research on the acquisition of temporality. The main data source was derived from an inter-university project on the acquisition of Italian by adult learners from different linguistic backgrounds. The data include conversations and narratives. In the context of this project, the main interest was on tense and aspect marking. Ramat argues that learners select tense and aspect markings according to the inherent lexical content of the verbs (Aktionsart). In addition, the expression of progressive aspect in Italian was studied. Progressive aspect is expressed by a progressive periphrasis, whose use is facultative, the simple forms of the indicative serving also the progressive function. The results of the study show that (1) learners do not use the periphrastic form for a period whose duration may vary, and (2) once more the semantic properties of verb categories (Aktionsart) are crucial in guiding the gradual mastering of progressive forms by the learners.

11. Research Group on Structural Grammar

In order to focus the research activities of the group, a joint project was initiated in 1994, the basic orientation of which is defined as "Minimalism and the Lexicon". It pursues problems initially determined by the questions

(a) What does lexical information tell the mechanisms of syntactic organization and semantic interpretation?

(b) How does grammatical structure determine conceptual interpretation?

This orientation takes up considerations underlying the so-called Minimalist Program of Linguistic Theory, applying them, among others, to the structure of lexical information and its role in syntactic and semantic computation. The challenge of this orientation is to take economy and conceptual parsimony as reflecting aspects of the mental organization to be analyzed, rather than merely as a matter of standard methodology. The project is intended to explore the consequences of this overall orientation with respect to specific issues, and to provide a framework for visitors to interact with.

11.1 Representational economy in lexical items

In earlier work, M. Bierwisch has shown that relevant generalizations about the structure of lexical items can be captured by means of disjunctive ordering and the Elsewhere Condition first introduced in phonology. In this connection, the mechanism of covarying variables as illustrated in (1) turned out to be of particular interest:

(1) /in/ [-V, -N, αDir] $\lambda x\ \lambda y$ [(αCHANGE) [y LOC [INT x]]]

[-αObl]

An entry like (1) collapses a directional and a locative preposition of

German within one disjunctively ordered representation, accounting for their respective categorization, subcategorization, and semantic form. The covariation of conditions in GF (Grammatical Feature-component), AS (Argument Structure), and SF (Semantic Form), found here and in a wide variety of other types of entries, raises the questions to whether this covariation might also involve variables of the Phonetic Form (PF), as suggested e.g., in (2):

(2) /g V b/ [+V,-N, αPast] λx λy λz λs [[GIVE x y z s] :
| (αTs BEFORE Tu)]
αlow

Irrelevant detail aside, (2) is meant to indicate the varying properties of past tense *gab* and present tense *geb* ('gave' vs. 'give'). On closer inspection, however, this move seems to be doubtful, if not mistaken, for at least three reasons.

First, the correct specifications needed for (2), including, among other things, Agreement Categories referring to Person and Number in different ways for Past and Present Tense would require extremely complex covarying feature values, making the intended simplification highly problematic, to say the least. Second, the partial systematicity governing strong verb inflection and related phenomena cannot be capured within this framework, even if the complexity mentioned before were to be ignored. Third, the inflectional pattern of a verb like *geben* is invariant across all its prefix- and particle-derivatives (like *vergeben*, *aufgeben*, etc.) which clearly must be represented by different lexical entries, such that the inflectional patterns would have to be repeated over and again – contrary to the principles of economy.

Within a more general perspective, this leads to the assumption, that lexical items are to be construed as comprising two types of information, one being subject to Spell-Out (in the technical sense of the Minimalist Program), and one being "invisible" in this respect. The former consists of PF and corresponds to the Lexeme in the sense of Levelt (*Speaking* 1989), the latter combines GF, AS, and SF and corresponds to Levelt's Lemma.

An immediate problem created by this otherwise well motivated bipartition of lexical information concerns the necessary correspondence between features in GF and conditions on PF, crucially involved in PF-alternations representing inflectional or derivational processes,

which motivated the considerations exemplified in (2). The answer to this problem is by no means obvious and is presently subject to further exploration.

11.2 Polysemy and contextual variability

Continuing work on the organization of the semantic-conceptual interface, R. Blutner and A. Strigin have been concerned with the central challenge in the proper treatment of polysemy: the so-called restriction problem. Observations show that formation of contextual variants is sometimes subject to strict systematic constraints, but is sometimes quite idiosyncratic. The German adjective *scharf* has a broad spectrum of possible interpretations (tactile: sharp knife, olfactory: biting smell, of taste: spicy soup, metaphorical: sharp remark), whereas the variability of its partial antonym *stumpf* is much more limited. Similar facts are observed with certain nouns (e.g., "institutional" words such as *school, government*) where the contextual variability of the words differs (*the school/government was criticized, the school/government was painted blue*). The restriction problem is also characteristic of prepositions, where the context variability, although rather broad in general (i.e., *mit* 'with' – in 'cut with a knife', 'leave with the friend', and, in German, *mit dem Sonnenuntergang*, i.e., 'with the sunset') is sometimes subject to systematic constraints, as in *mit dem Sonnenuntergang ankommen* vs. *??mit sechs Uhr ankommen* 'to arrive at sundown' vs. 'to arrive at six o'clock' or *mit dem Strom schwimmen* vs **mit der Straße fahren* 'to swim with the stream' vs 'to drive with the road'. The treatment of polysemy explored by Blutner and Strigin is based on the assumption that polysemous lexemes are represented by underspecified logical forms. These underspecified structures have to be completed on the basis of the conversational background. The resolution of this completion task is the central goal of this research. The task is carried out by means of weighted abduction - a mechanism which generates specifications, and simultaneously evaluates their 'cost'. Only those variants which have minimal costs are accepted. This reduces the number of hypotheses and allows the mechanism to converge on a unique interpretation.

11.3 Meaning variation: Semantic Form and parameter specification

Exploring the conditions that make it possible to associate a given linguistic expression with several interpretations systematically related to one another, J. Dölling has developed an approach which is based on few general procedures and, in this way, is fundamentally uniform with respect to all relevant cases of meaning variation, such as variation on the basis of polysemy, metonymic variation, variation between kind or instance interpretation of predicate expressions, variation in attributive or adverbial modification etc. More specifically, Dölling has given an explanation that is more in agreement with the interface theory of semantics as well as a minimalistic attitude to lexical semantics. Taking up the notion of Semantic Form SF and connecting it to abduction as a major principle of interpretation, the contribution of separate mechanisms involved in the phenomena of conceptual restriction and conceptual shifting has been elaborated.

Contrary to a previous proposal made by Dölling, no differentiation between semantic sorts of linguistic expressions in addition to their usual division into logical types is assumed at the level of SF. Therefore, it appears that semantic coercion operations which are advocated by several researchers to meet sortal selection restrictions are quite unnecessary. Instead, the approach proposed by Dölling takes into consideration that SF representations only deliver the basis of interpretive adjustments in so far as they include certain parameters which must be fixed with respect to the linguistic and situative context. Two types of SF parameters are distinguished. First, many lexical items (e.g., nouns, verbs, adjectives, prepositions, determiners) display an underspecified meaning, including parameters in their semantic component. Second, and perhaps more interestingly, there is a set of so-called SF affixes containing parameters, which are obligatorily applied to predicates at every step of semantic composition and, thereby essentially extending the potential of meaning variation of the respective expression. Taking into account Parameter-Specified Forms PSF that represent different readings of an expression, Dölling made explicit the way in which different PSFs result from abductive interpretations of the SF in regard to conceptual knowledge.

11.4 Directionality, movement and coordination

C. Wilder's research focussed on right-left asymmetries in simple sentences and complex coordinate constructions, in the light of Kayne's (*Antisymmetry of syntax* 1994) proposal that linear order is fully determined by hierarchical relations, and Chomsky's thesis (*MIT Working Papers in Linguistics* 1994) that hierarchical information only is represented in syntax, with linear (right-left) distinctions available only for operations of the phonological component.

The traditional analysis of backwards "extraposition" dependencies (1) as movement rightwards of the clause out of the NP is incompatible with Kayne's claim that movement is only leftwards:

1) He made [the claim _] yesterday [that John will win]

It is proposed that the construction (1) derives from partial phonological deletion (in parentheses) over copies created by a "leftward movement" of NP:

2) He made [the claim (that J. will win)] yesterday [(the claim) that John will win]

The partial deletions indicated match those independently assumed in coordination. Drawing the analogy from movement-copies to conjuncts, deletion targets material at the left edge of non-initial copies and at the right-edge of non-final copies:

3) [John bought (the paper)] and [(John) read the paper]

The deletion-based analysis of extraposition captures generalizations, in the form of properties shared by extraposition and backwards deletion in coordination, that are left unexpressed in a movement analysis of extraposition. That extraposition from NP is only possible from the right edge of NP matches the fact that backwards deletion sites may only appear at the right edge of non-final conjuncts. It also allows asymmetries between extraposition and genuine ("leftward") movement dependencies to be captured in terms of independently established differences between forwards and backwards deletion-dependencies in coordination.

11.5 Syntactic and lexical properties of German *wie*

Continuing research on syntactic categories, comparative constructions and sentence initial elements (conjunctions and w-phrases), I. Zimmermann argued for the syntactic feature ±adverb in addition to the common features ±verb, ±noun. She marks the functional category C as +C for complement and relative clauses and -C for independent clauses. Analysing clause initial *wie* in German as a particular case in point that participates in several of the possibilities in question, she specified its multifunctional character as a temporal, descriptive conjunction or as a w-phrase in SpecC in various types of sentences. The work is related to considerations on minimalism in the syntax-semantics correspondence and in the organization of lexical information.

11.6 Predication and psychological aspects in action verbs

Looking at pairs of sentences like

(1) Mary bought the book from Fred
(2) Fred sold the book to Mary

A. Roßdeutscher, while visiting the research group, argued that even though (1) and (2) seem to identify different Agents participating in the events described, they do not refer to actually different transactions. (1) and (2) rather differ by the perspective they take with regard to the respective Agents: In order for Mary's buying a book from Fred to be a successful action of hers, she must agree with Fred on the telos of their action, i.e., she as well as Fred must have the intention do their part to bring the change of possession about; and they both must have mutual beliefs that the other party has the intention to do his or her part as well. What is done must be conceived by the respective agents as the attempt to realize the shared intentions. As both parties share these attitudes, the successful action referred to either by 'buy' or 'sell' is conceived as a realization of the intentions of either party. We have one complex event of cooperative action. The difference in predication of the verbs 'buy' and 'sell' concerns the psychological attitude of that

agent the event is bound to. Roßdeutscher developed a proposal to include the characterization of the intentional perspective in the relevant sense into the framework of Discourse Representation Theory.

11.7 Minimalist approaches to derivation and representation

J. Ouhalla carried out research relating to his attempt to construct an alternative "minimalist" approach to derivation and representation. Central to the approach is the idea that derivation and representation are governed by two overarching principles, one called *The Identification Requirement*, the other being the well-defined *Principle of Economy*.

The Identification Requirement requires that the abstract features encoded in functional categories (e.g., agreement features) be recoverable from the properties of surface representations. The mechanisms of identification can involve, among others, morphological means (e.g., agreement morphemes) or syntactic means (in particular agreement, adjacency and binding relations). It is argued, on the basis of a relatively broad range of comparative data, that movement of phrasal categories is driven by the need to identify the features encoded in the functional categories associated with them, in situations where those features cannot be identified by morphological means. Movement of the verb is also argued to be driven by the same requirement, the underlying idea being that verbs originate already inflected for agreement and tense morphology.

The Principle of Economy has the function of ruling out representations which involve over-identification. For example, if the agreement features of a functional category are morphologically identified, movement of a noun phrase bearing the same features to a related adjacent position is excluded. This restriction derives, among other things, the complementary distribution between rich subject agreement morphology and a subject found in Standard Arabic and the Celtic languages. Likewise, if the feature [+Q(uestion)] of a wh-question is morphologically identified by a Question-morpheme, the fronting of the wh-phrase to the position of the feature (Comp) is excluded. This restriction derives the lack of movement of wh-phrases to Comp in languages which have a Question-morpheme.

The Identification Requirement and the Principle of Economy, by virtue of their definition and function, apply at the Surface

Structure. The radical consequence of this arrangement is that the level of Logical Form, as a derivational level, becomes superfluous. The structural aspects of meaning (such as binding and scope relations between quantifiers) are argued to be encoded at the level of Deep Structure, and, derivationally, also at the level of Surface Structure.

12. Other Research

12.1 Visual word recognition

Together with C. Burani (Instituto di Psicologia del CNR, Rome) and R. Schreuder (U. Nijmegen), H. Baayen investigated the processing of a number of Dutch derivational prefixes in visual word recognition. In a lexical decision task, subjects had to reject as words nonwords in which a prefix was followed by an orthographically legal but non-existing pseudo-stem. Compared to orthographically matched nonword controls without any morphological structure, the prefixes *ultra-, hyper-, aarts-, wan-* and *on-* required significantly longer processing times, suggesting that these prefixes have their own access representations in the mental lexicon. For the prefixes *be-, her-*, and *oer-*, no significant effects of morphological structure could be ascertained. A multiple regression analysis suggested that semantic transparency and the length of the prefix play a crucial role. Nonwords with long transparent prefixes are difficult to reject as words in visual lexical decision. No effect could be established of various distributional properties of these prefixes, such as their type and token frequencies, or the number of pseudo-prefixed word types and tokens with these prefixes.

Together with Schreuder and T. Dijkstra (U. Nijmegen), Baayen continued his investigation of the processing of plural inflections in Dutch. Earlier experiments had revealed frequency effects for regular plurals with the suffix *-en*. Whereas reaction times for singular nouns were determined by the summed frequency of the singular and the plural, the reaction times to plural nouns were determined by the surface frequency of the plural itself. Plural dominant plurals (plurals with a surface frequency exceeding that of the corresponding singular) are processed as fast as their singulars. However, singular dominant plurals (plurals for which the frequency of the singular exceeds that of the plural) required substantially longer response latencies.

Is the same pattern of results to be expected for *-en* as the plural inflection on verbs? An investigation of the lexical statistics of plural inflection on nouns and verbs revealed that plural dominant

plurals are restricted to nominal inflection. This suggests that in the case of nouns, concept formation may be involved, whereas in the case of verbs, syntactically determined inflection is at issue. This hypothesis is supported by an experiment in which (singular dominant) singulars and plurals of nouns and verbs, matched for surface and stem frequency, were presented in a lexical decision task. As in the previous experiments, the noun plurals required significantly longer response latencies than their corresponding singulars. For verbs, however, the response times for plurals were only 10 milliseconds longer than those for the corresponding singulars. This suggests that the recognition of the constituent morphemes of verb plurals is virtually instantaneous, and that upon identification of the plural affix the agreement feature of plurality is made available for post-lexical syntactic processing. The much longer response latencies observed for the noun plurals, by contrast, suggest that additional processes are involved.

One such process may be concept formation. But, perhaps more importantly, the ambiguity of the *-en* suffix, which also occurs as the marker of infinitives and participles, may give rise to a default interpretation of *-en* as a verbal inflection. When attached to nouns, the default verbal reading of *-en* (*-en* occurs more often as a verbal inflection than as a nominal inflection in the CELEX lexical database of Dutch) has to be replaced with its nominal reading. This may require additional processing time and lead to longer response latencies.

F. Hellwig (U. Nijmegen), in collaboration with U. Frauenfelder (U. Geneva), Schreuder, and Baayen, continued to test the predictions of the Morphological Race Model (MRM). The MRM predicts that pseudo-words composed of existing affixes and non-existing stems should take longer to reject in a lexical decision task than pseudo-words with no internal morphological structure. This is due to the recognition of the existing affixes by the morphological decomposition taking place. An experiment compared the lexical decision latencies to complex pseudowords (with four different Dutch derivational affixes) and matched pseudowords without any internal structure.

According to the MRM the productivity of an affix is a good predictor of reaction times. The lexical decision latencies of Dutch adjectives with a highly productive derivational suffix (*-baar*) were compared to adjectives with a largely unproductive suffix (*-lijk*). The results confirmed the predictions. Pseudo-words composed using the

same suffixes (*-baar*) and (*-lijk*) applied to non-existant stems were also tested. As predicted, the psudo-word with the productive suffix (*-baar*) took longer to be rejected.

Word frequency models build on the fundamental assumption that words occur randomly in texts. It is clear that for natural language this assumption is too strong. The syntax of natural languages imposes severe constraints on where words can occur. For instance, following the Dutch determiner *de*, adjectives and nouns, but not verbs, are allowed (*de lamp*, *de felle lamp*, **de schijnt*). Similarly, semantic constraints and principles of discourse organization may severely limit the way in which words occur in texts. This raises the question to what extent the predictions of probabilistic models that build on the randomness assumption can be relied on, especially since it is known that non-parametric estimates of the number of different word types for the initial M tokens of a text, obtained on the basis of the frequency spectrum of the N tokens of the complete text (M<N), tend to overestimate the numbers of types actually observed.

Baayen has shown that this divergence between the observed and expected number of word types in a text does not arise at the sentence level. For various novels, he produced artificial versions by randomizing the order of the sentences, while leaving the order of the words in these sentences unchanged. For these minimally randomized texts, the urn model accurately predicts the number of different word types as a function of text size. This shows that syntactic and semantic constraints operating at the sentence level cannot be held responsible for the divergence between the observed and expected numbers of different types in normal running text.

By studying the distribution of lexically specialized words in running text, Baayen was able to show that this divergence arises due to the scarcity of specialized words in the initial parts of the text. Apparently, it is the organization of texts at the discourse level that is at issue. In the initial sections of the text, the reader is introduced gently to the fictive world of the novel. Here, large numbers of specialized words are avoided. Once the general topic domain has been established, specialized vocabulary is used to elaborate more specific topics in full.

12.2 Aphasia

C. Heeschen carried out an experiment in which agrammatic patients had to tell picture stories in both a non-interactional and an interactional situation. (Non-interactional: the stories were told to the experimenter who knew the stories already and who did not ask questions or give comments. Interactional: the stories were told to the closest partners of the patients, who did not know the stories, and who were free to intervene with questions and comments.) It turned out that in the non-interactional situation, the agrammatics did not resort to a telegraphic style (as predicted by Adaptation Theory, see Annual Reports 1990, 1992, 1993). However, in the interactional situation, the patients did show strong trends towards telegraphic style. In the meantime, an argument has been raised that an interactional situation brings about a higher cognitive load and/or higher attentional demands for the patients to which they adapt by simplifying their utterances. In order to check this, in 1994, the patients had to tell the stories again in a non-interactional situation, but this time they had the additional condition to perform a choice reaction task simultaneously with telling the stories. This additional attential demand, however, did not make the patients resort to telegraphic style. It is concluded that "interactionality" as a SOCIAL category is the factor driving the patients to adaptation by applying telegraphic style.

Heeschen and E. Schegloff (UCLA) began the Conversation Analysis of naturally occurring conversations between aphasic patients and their closest partners. One primary aim of this project was to find out the potential interactional advantages of telegraphic style. An initial result of the observations is that shortness and incompleteness (characteristic features of telegraphic style) can be an interactional resource specifically if the patient wants to open or to continue a topic. The incompleteness provokes the partner to ask questions by which s/he inevitably becomes engaged in the topic desired by the patient. The generalizability of these observations still remains a problem, as well as the question as to whether the practice of "being short and incomplete" can be found also in normals.

In the last two years, some attempts have been made by aphasiologists in English speaking countries to replicate the basic findings of Adaptation Theory as put forward by H. Kolk (U. Nijmegen) and Heeschen. These replications yielded only weak support

for Adaptation Theory. Specifically, Kolk and Heeschen's hypothesis that agrammatic telegraphic utterances have the same structure as normal contextual elliptic expressions could not be confirmed for English. However, the reason for this might consist in the fact that little is known about the structure of regular contextual ellipsis in English.

Heeschen and J. Christiansen began a systematic exploration of the convergences and divergences of ellipsis in English and German (and partially in Dutch). The first results are as follows. The core phenomenon in German (and Dutch) elliptic expressions is the omission of finiteness, resulting in the use of infinitives for present tense and past participles for the past tense. The omission of finiteness is also present in English ellipsis; however, it invariably involves the omission of auxiliaries including the *do* in do-support constructions. For the substitution of inflected main verbs by infinitives there is no equivalent in English. Elliptical forms in German preserve tense information, those in English ignore tense but preserve aspect: *you get the letter?* can be understood as either *do you get the letter?* or *did you get the letter?* depending on context. However, *get* preserves the aspect of punctuality. In *you taking a break?*, again, tense information is lost, but the durative aspect is obligatorily marked by the *-ing*. There is an interaction between aspect and mode in English ellipsis. While in questions, the initial auxiliary can be omitted under almost all circumstances, this is not the case with declaratives. For example, statements which indicate the punctual or habitual aspects in the present or past tense cannot be expressed by a non-finite elliptical utterance. Thus, the English *I take the subway to work* cannot be reduced, while a German equivalent *(U-Bahn nehmen)* is possible given the appropriate pragmatic context. These examples seem to suggest deep structural differences between English and German ellipsis requiring further exploration.

D. Wilkins continued his work as one member of a research team which includes N. Dronkers (V.A. Medical Center, Martinez and U.C. Davis), J. Jaeger (SUNY Buffalo), B. Redfern (V.A. Medical Center, Martinez) and R. Van Valin Jr. (SUNY Buffalo). A study concerning the brain areas involved in the disruption of morphosyntactic comprehension was conducted on twenty chronic aphasic patients with single left hemisphere lesions. Lesions were computer-reconstructed from CT and MRI images onto standardized templates to facilitate

computerized comparison of patients' lesions and to allow for overlapping of lesions in patients with similar linguistic problems. A slightly revised version of the CYCLE-R (Curtiss-Yamada Comprehensive Language Evaluation - Receptive measures) was used to assess morphosyntactic comprehension.

The studies found that aphasic patients with severe morphosyntactic comprehension deficits had brain lesions that encompassed a cortical area in the anterior superior temporal gyrus in the left temporal lobe. This area corresponds to the anterior portion of Brodmann's area 22. All five patients whose lesions included this area performed poorly on the tests, while all the patients who performed well had lesions that spared this region. Although all the patients with lesions in anterior area 22 also had damage to Broca's area, it is not the case that all patient's with lesions in Broca's area had morphosyntactic comprehension problems. Indeed, the only patient to score 100% on all subtests possessed a lesion in Broca's area. Thus, anterior area 22, but not Broca's area, clearly differentiates those patients with the most severe morphosyntactic comprehension problems from those without.

These data, with corroboration from other studies, indicate that anterior area 22 in the left cerebral hemisphere is involved (possibly in connection with Broca's area) with comprehension of morphosyntax and should be considered in future discussions of the brain regions which subserve language.

This year saw the completion of the "Reader in the history of aphasia", edited by P. Eling (U. Nijmegen). The initiative to prepare the reader was taken in the early days of the Institute. The aim of the book is to make accessible the original texts of the classical aphasiologists of the 19th and early 20th century. The original French and German texts were translated into English and present-day experts prepared introductions to the original texts.

12.3 Acquisition of morphology and syntax

J. Weissenborn – in collaboration with Z. Penner (U. Bern) und M. Schnenberger (U. Genf) and in continuation of earlier work on the acquisition of word order (cf. Annual Report 1993) – investigated the acquisition of AGR(Verb) placement in German in the light of recent proposals made within the minimalist-antisymmetry approach. The

basic claim of this approach is that the V2(main clause)-Vend(embedded clause) asymmetry of verb placement in Germanic should be derived from an underlying head-initial AGR-phrase (SVO). This is contrary to the traditionally assumed underlying head-final AGR-phrase (SOV).

The minimalist-antisymmetry approach to the acquisition of AGR placement in German makes clear predictions with regard to the potential positions in which AGR markers are allowed to occur during development: They should be (a) preferred on COMP in subordinate clauses and (b) ruled out in (both main and embedded) clause-final positions.

In addition to verbal inflection, AGR in Early German can also be expressed by (a) "parasitic" subject clitics (e.g., in clitic doubling configurations), (b) expletive verbs (of the TUN "do" type), and (c) copying configurations. An analysis of extensive naturalistic corpora in different varieties of German reveals that the predictions of the minimalist-antisymmetry approach are not borne out by the data: (1) There is no convincing evidence for AGR-in-COMP in subordinate clauses in early grammars (neither for overt COMP or preconjunctional subordinate clauses); (2) The finite verb may occur clause-finally both in main and subordinate clauses. Especially in the non-standard varieties of German, the inflected verb in the clause-final position may be linked to an AGR marker in the above sense (V + subject clitic, expletive verb, expletive + subject clitic, etc.); (3) V2/Vend-AUX-copying patterns are attested. These data clearly suggest that contrary to the minimalist-antisymmetry aproach, early verb placement can be best accounted for in terms of clause-final AGR.

Additional evidence for this analysis comes from language impaired children: While the clause-final AGR pattern in normal-speaking children disappears rather early (1 year 6-9 months or even in the "silent stage"; note that the Vend pattern survives longer in interrogatives than in declaratives), giving way to verb movement to the left periphery, it is fairly stable feature of the grammar of SLI children. Moreover, an investigation of agreement patterns in mentally-retarded children (Psycho-Organic Syndrome) has shown that, while clause-final finite verbs correctly agree with the subject, inflected verbs placed in the left periphery of the clause tend to disagree with the subject (e.g., 1./3.sg mismatching).

This acquisition data cast serious doubts on the empirical

adequacy of the minimalist-anti-symmetry approach to verb placement and support the traditional underlying SOV approach.

Weissenborn, S. Powers, P. Jordens (F. U. Amsterdam), in collaboration with M. den Dikken (HIL/F.U. Amsterdam) and H. Bennis (HIL/RU Leiden), have investigated the emergence of the verb particle construction (e.g., *call up* or *opbellen*). Spontaneous longitudinal data from five Dutch children (from the CHILDES database) was coded. Data from six other Dutch speaking children which was already coded was also included in the analysis. In addition to spontaneous corpora data, diary data from three Dutch children starting from the age of 1 year 3 months was investigated in order to determine when verb particles first emerged.

The main finding is that children learning Dutch produce particles in isolation (e.g., *op*) before particles appear in particle verb constructions (e.g., *opbellen*). Moreover, there is no evidence that an analysis of these constructions as a verb and particle forming one complex entity is preferable to an analysis of the particle as a predicate in its own right. We argue that this latter is the correct analysis of the verb particles which initially appear in isolation. Further, this analysis accounts for the observed acquisition sequence. We are currently extending this analysis to the verb particle construction in child German and child English data.

Jordens examined the acquisition of aspect in Dutch. In an earlier study on the acquisition of word order (cf. Annual Report 1994), it was observed that particular verbs as given in (1) are always used with past-participle morphology, whereas other semantically related verbs as given in (2) are always used with non-finite morphology.

(1) *vinden* Knikker heb ik gevonde
('marble have I found')

(2) *zoeken* Papa, wil je potloodje zoeke?
('daddy, would you pencil look-for?')

Examining a Dutch corpus of spontaneously produced child utterances, it was found that verbs ending in *-en* are associated with prospective aspect, verbs ending in *-Ø/t* have either imperfective or perfective aspect and verbs with past-participle morphology encorporate perfect

aspect.

One hypothesis to account for these and other distributional differences between the verbs would be that the child has associated particular aspectual characteristics as part of the lexical semantics of the verbs. These lexicalized aspectual characteristics are then also expressed morphologically. Investigation of the corpus shows a correlation between the semantic type of a verb and its associated morphology and word-order position. This suggests that a hypothesis of lexicalization of aspectual contrasts is correct.

P. Indefrey in collaboration with R. Goebel (T.U. Braunschweig) continued his work on network models of inflectional morphology. A recurrent network with short term memory capacity that correctly generalized weak noun declension (see Annual Report 1993) was presented with the task of assigning plural to a set of nonwords which had been used in a plural judgement task with adult subjects by Marcus et al. (*Proceedings of the 15th Annual Conference of the Cognitive Science Society*, 1993). The network distinguished generalizable (*n*-, *e*-, *s*-) and not generalizable (umlaut, *r*-) plural markers, but did not treat the *s*-plural as the only generalizable ('regular default') plural form as postulated by Marcus et al. The simulation finding, however, is in line with the data of Marcus et al. and with the results of a production experiment of Köpcke (*Lingua*, 1988). Indefrey collected further linguistic data showing that *n*- and *e*-plurals can apply in default circumstances. It is concluded that not only the *s*-plural but also the *n*- and *e*-plurals are regular in German. The German plural, therefore, cannot provide crucial evidence in the debate about rule vs. associative memory representation of inflectional morphology.

12.4 Epistemic evaluation and discourse

J. Nuyts (U. Antwerpen) and W. Vonk started collaborative research on discourse factors in the use of epistemic modal expressions. The project aims to investigate the role of information structure (topicality/focality, saliency of parts of information) in the use of alternative expression forms for epistemic modality (modal adverbs, modal predicative adjectives, mental state predicates, modal auxiliaries, modal particles, etc.). Data have been gathered in an experiment, in which subjects were invited to comment on cartoon strips which were likely to cause

epistemic evaluations. The cartoons were varied to set up alternative kinds of discourse situations for those epistemic evaluations. The experiment was performed in spoken and in written form.

12.5 Interjections as deixis

Expanding on work published in 1992, D. Wilkins argued that interjections (i.e., elements such as *ow!*, *wow!*, *hi!*, *thank you* and *hey!*) are complex deictics which contain one or more basic deictic elements (e.g., *I*, *you*, *this*, *here*, *now*) in their semantic structure, and this determines their use, selection and interpretation in narrative discourse.

Evidence adduced in support of these claims are: (i) Interjections commonly have basic deictic forms incorporated as part of their lexical form (*thank you*, *dammit*, *gimme*, *welcome*); (ii) Basic deictic elements often diachronically give rise to interjections, or form the root from which interjections are derived (e.g., by reduplication, *now now*, *there there*, *come come*); (iii) Like demonstratives and pronouns, interjections frequently require an accompanying deictic gesture, or have a roughly equivalent physical gesture that includes a deictic component; (iv) Also like demonstratives and pronouns, interjections may violate phonotactic and other phonological constraints that are typical for the rest of the lexicon; (v) While interjections can occur in direct discourse reports, they are just like other utterance-bound deictic elements in that they must be deictically shifted in indirect discourse (e.g. *"Shit! I'm bored!" Sally said* would have to be rendered in an indirect quote as *Sally said that she had just come to the unpleasant realization that she was bored.*

In narratives, interjections on their own often signal the occurrence of a direct quote, and they correlate highly with shifts from narrator's perspective to character's perspective, or from one character's perspective to another's. Using Deictic Shift Theory as developed by the Narrative Group at the SUNY Buffalo, Wilkins has argued that readers of a narrative text can only interpret an interjection, such as *Wow!*, in that text if they have mentally constructed a (fictional) story world and are at an "active" space-time location within that story world (the deictic center) that allows the deictic elements in the semantic structure of the interjection to be contextually assigned referential values.

Other Activities 1994

Activities of the Technical Group

In 1994 many transitions created extra work for the Technical Group and trouble for the users. Due to these changes training courses, including courses by external companies, were run to increase the knowledge of the users. A major task of the TG was to provide good training and distribution of information about the facilities. Lack of know-how about the many details and tricks in a world of continuous migration and change prevents the scientists from using the facilities as efficiently as is desirable. These efforts will be intensified in 1995 by using more on-line information offered with help of up-to-date software like Mosaic/WWW. The TG organized a "fair" where various setups and tools were demonstrated to the institute's members. This was well accepted and will be repeated.

In parallel to the many changes of the existing facilities, the TG finished some new set ups and made major development steps.

Facilities for the Cognitive Anthropology Research Group

New small and light audio, video, and computing field equipment was integrated. After some investigations, the new HP-Omnibooks turned out to be optimal notebooks for general transcription and editing work in the field, since they are very light and can operate for about 4-8 hours on battery charge. For more advanced field work, including running experiments with color screens, new Toshiba notebooks (T1910cs) were chosen. Toshiba notebooks have now used for some time in the field with a high degree of reliability. Small PCMCIA-based interfaces, hard disks, modems, and Ethernet-adapters have been tested successfully and they will be used increasingly often in PCs and especially notebooks.

Of special importance was the introduction of powerful radio microphones for field work, allowing high quality recordings even when subjects are moving. Two such sets were bought and used extensively. This technology is still expensive when certain quality and flexibility standards have to be met. Various expeditions were equipped and in general the equipment proved very stable.

New Power-Macs have been integrated to allow on-line video handling and new setups were installed to do video editing and manipulation. Up until now, there have been no problems with these new MACs, although the full power can only be used by the new software versions running native code.

Gesture Lab

The Gesture Lab has been built up and used intensively for experiments with qualitative registration of gestures. In this setup, subjects' verbal and gesture activities are registered with help of video equipment. Thereby the speech signal, experimental conditions and events, and the video sources of two cameras are all mixed on a split screen recorder. Due to the video processing involved, a delay is introduced. Therefore, all non-video sources (for example speech) must also be delayed to achieve a time-synchronized recording.

A gesture transcription environment has been developed which consists of a U-Matic video player, a PC with a video board, a RS422-based interface between both, and a software package. This allows convenient control of the video device simultaneous with input gesture transcriptions. This is achieved by offering a whole scheme of possible gesture categories graphically and giving the transcriber the possibility to make choices with a mouse. Times are also directly copied from the video source onto the transcribed text.

In 1995, the Umatic systems will be gradually replaced by new S-VHS recorders which offer both a high-quality still-picture and slow-motion sound, as well as many technical advantages compared to the old Umatic standard.

The whole gesture setup has also been prepared to use ultra-sonic equipment for more quantitative studies. Both setups are synchronized by clear start/stop conditions and signals and experimental events are time synchronously stored along with the three signals: body positions measured with help of ultra-sonic methods (200 Hz), speech signal (10 khz), and video information. The intent is to first transform the ultra-sonic signal with special differential filters to generate four signals over time: the three spatial co-ordinates and the speed. These signals are then converted into the same data format as is used for the speech signal. All signals can then be entered into the Xwaves/ESPS speech analysis package for detailed analysis and labelling.

Mac-based video analysis

In the future, analysis and transcription of video scenes will certainly be computer-based. However, technology is still not fully adapted to the needs of handling video signals on computers both in terms of needed bandwidth and storage capacity. Nevertheless, the TG further improved the MAC-based video analysis system. This Quicktime-based software package allows the presentation of video movies, speech signals, and several layers of text in a synchronized way. It also enables the user to directly compare video scenes including the same or similar gestures.

The ultimate goal of this project is a system where the experimenter uses the PC-based analysis setup (see above) to do a first rough transcription of the video material in a sequential manner. These codes are then input to a relational gesture database (already designed in ORACLE) to allow the user relational queries to get lists of selected gestures and utterances. The output of the database can be used to generate the text tracks in the Quicktime environment. After having digitized the important video scenes, all available information can be displayed synchronously and further codes can be added in a user-friendly manner since there are no limitations with respect to the control of the signals as in the case of using video equipment. These added codes have to be transferred back to the database to allow enhanced queries. This system has been designed and is currently being implemented. The integration will be finished in 1995.

However, technological limitations have to be considered. The video signal has to be digitized and compressed (MPEG) which now is done in software and takes about 200 times real-time. The decompression is done in real-time by the processor of a Power-Mac and one can achieve pictures with 384x288 spatial and a 25 frames per second time resolution. Improvements can only be achieved when faster hardware is available. This can be expected in 1995. The problem of handling the enormous amount of disk space needed to allow on-line access to the video data will be solved in 1995 with help of an archive server with large amounts of secondary and tertiary storage capacity (n x 100 GB).

Speech Lab

The speech lab software tools based on the XWaves/ESPS signal processing software package now run smoothly on our HP and SGI

workstations. Most staff members have one of these on their desk and are able to directly access speech material. The way the XWaves/ESPS software is setup allows one to modify and extend the user interface and functionality of the speech lab tools in a very flexible way. In 1995, we intend to extend the functionality of the splicing program in order to make splicing less labor intensive.

The speech lab tools have been integrated with the CED editor of the CHILDES system. This integrated system allows a researcher to directly access the corresponding speech signal when working with a transcription. Because this access takes place using the standard speech lab tools, all signal processing facilities such as spectrograms and F0 contour generation are available. In their turn, the speech signal and the results of its analysis may serve as the basis for a transcription. A multi-tasking operating system is needed for the integration between the speech lab tools and CED. Accordingly, the easily extendable speech processing tool XWaves/ESPS is available only on Unix.

Together with the CMU and SPEX, we will look for possibilities to make similar CED enhancements for the MAC and MS-Window platforms.

Accessing speech signals from Childes transcriptions requires substantial secondary and tertiary storage capacity, since on-line access to the speech signal of the whole corpus is required. This can be solved by providing an archive server with large storage capacity in the local area network. Another crucial point is that the speech has to be digitized and that the time markers have to be set manually.

Corpora

Several on-line corpora are accessible at the MPI. The most important are those from CHILDES and the ESF project. The CHILDES corpus has been completely reorganized and is still offered on three platforms: MAC, PC, and UNIX. After having done a feasibility study, it has been decided that the ESF corpus will be converted to the CHAT format used in CHILDES. The institute started to assemble a TROUW corpus. This corpus includes the complete text of the Trouw newspaper. It is in SGML format, includes complete tag description, and it covers about 10 MB of text each month. Together with the Dutch CELEX database, it will offer many possibilities for statistical analysis.

Some work has been done to optimize the MARSEC corpus of spoken English which is fully labelled with orthographic descriptions.

The task was to write programs that can find embedded words even across word boundaries. This attempt turned out to be problematic in that the grapheme-to-phoneme converters produced too many errors when tested. New approaches have to be found here.

Facilities of the Neurocognition project

Two labs are now available which allow connection of up to 64 channels for real brain mapping. Currently both labs register 16 channels, but this will be expanded in 1995. With 16 channels, spatial aliasing occurs which can lead to misinterpretations. Especially with source modeling, one needs a higher spatial resolution. The VAX-based brain atlas from Upsala University for the normalizations is now available on UNIX machines too, i.e., it is not necessary anymore to step over to other atlas implementations. The visualization of PET data can be done with the help of IDL procedures.

Eye movement lab

The whole hardware and software setup has been optimized so that experiments can be carried out more efficiently. Since the technique uses only scattered IR-light reflected from the iris, a high degree of mechanical stability is required. Therefore, a special table to fix the eye tracker has been built. This table also allows one to flexibly fix the monitor to display the stimuli. A double PC configuration has been implemented: one PC controls the complete experimental timing and the other PC is dedicated to data acquisition and the control of the eye tracker. Careful investigations have shown how the eye tracker works in detail and how the eye movement patterns are calculated.

For the control of the experiment, a program has been developed which operates on a structured ASCII file containing information about the sequence of stimuli to be presented and the mode in which this has to be done. This allows the user to flexibly design an experiment and to easily change it. A special text editor has been built which allows us to create typical text file objects in some pixel formats and object descriptions. The pixel files are used by the experiment program to present the stimuli and the object descriptions can be used to later analyse the eye movement patterns. A close co-operation is planned with the University of Aachen to develop the object analysis programs. Initial experiments have been carried out successfully and the setup will be further optimized in 1995.

NESU

The NESU visual experiment specification and execution software has now also been used in the Neurocognition labs for experiment control and stimulus presentation. It is also intended to use it in the new Child Lab. Besides these special applications, there are four full setups and a number of portable setups available, which allows many experiments to run in parallel.

NESU has been extended by many useful features such as:

- the possibility of entering scores by using the keyboard
- the possibility of also using the voice key offset
- the ability to design experiments using the video retrace on the specification level
- run-time optimizations to reduce the inter-trial time
- enhanced monitoring of the experimental timing for the experimenter
- inclusion of animations with cartoons or text and speech file sequences
- a more flexible definition of display colors

Due to the usage of high speed connections, it is now easy to down-load many speech files from the speechlab directly to the speechservers. A few remaining bugs were detected and removed. New fast PC and new generations of powerful laptops/notebooks were tested with NESU. The NESU software runs on all these platforms, if there is enough memory available (≥4 MB) and if the CPU is fast enough (386/486/Pentium). The only source of trouble seems to be the special design of some printer ports. Before running NESU this has to be checked.

A new PC-Box (version II) with enhanced functionality has been designed for out-of-house experiments. It is currently being tested with NESU and will be available in early 1995. This box will be hooked up to the printer port and can run multi-subject experiments by allowing several push buttons and microphones to be connected. On-box pulse read and write circuits and standard bit-I/O give the user a high degree of flexibility. NESU is available in three versions: full-NESU uses larger timer-servers and speech-servers which are connected via an IEEE interface to the host PC, portable-NESU which uses a PC-box connected to the printer port, and soft-NESU where the

PC-keyboard is used to enter reactions. NESU can work with one or two monitors. In the two monitor solution, experimenter feedback can be given. With the help of a splitter box, several monitors can be connected which allows for running up to four subjects in parallel.

The development of a new speech server solution from applying off-the-shelf sound cards has not yet been finished. New efforts will be made in 1995. NESU is now used by several other university labs in Europe. An ftp account will facilitate the distribution of new versions and will allow enhanced communication between the various users. All interested persons can acquire access rights.

Child Lab

The Child Lab has been completely redesigned to make it more suitable for experiments with small children. A separate sound-protected booth for the experimenter and the equipment protects against distracting the child. The lab has been constructed in such a way that various types of experimental designs are possible without mechanical changes.

Animation

The institute started to investigate the possibility of using computer-based animations for various purposes. Some software packages have been tested and first animations have been created in conjunction with an external company. An external company creates basic objects and movies and subsequent fine tuning or changes could be done at the institute. Such an interaction calls for usage of the same software. It seems that the institute will choose Lightwave and 3D-Studio. Although Softimage seems to be a superior product, it requires more hardware and human resources. It is clear that for good rendering, high power computers will be necessary.

General video aspects

An audio/video archive was set up (with the Oracle database software) which contains descriptions of the huge mass of tapes and cassettes. The video lab of the institute was restructured to fit the needs of normal video editing, copying, and manipulation work on the one hand and analysis work of the gesture lab on the other. The amount of video processing in the institute has increased dramatically from both observational materials and video stimuli prepared for experiments.

Network

The institute's local area network is completely based on Ethernet and therefore has a bus topology. Measurements have shown that this network is already overloaded during the peak hours between 9 and 10 am. An average load of about 30% with temporary peaks higher than 50% shows that there is no capacity left for new applications. A plan for a new network with intelligent hubs, star topology, and enhanced bandwidth has been worked out. The keypoints are 100 Mbps access from/to the desk and high speed links to the server computers. A detailed proposal will be presented in 1995 and realized in parallel with the expansion of the new wing to the building.

The institute's PCs and MACs are now connected via Novell software to the local network. This connection operated very reliably and removed the various access problems of the users and some of the management problems of the TG. The users have stable and flexible access to all resources of the local network inclusive of the servers and the international communication lines. For email, the institute is now using the ECS/Pine mail software which gives identical window-oriented user interfaces on PC and MAC. A window version is also in preparation for UNIX. It uses the same folder structure as UNIX mail and is able to handle the MIME protocol which allows one to send and read non-ASCII documents via email directly.

The whole domain specification of the institute's local network as a part of the world-wide Internet was changed to 'mpi.nl' which is also the official email address. Home PCs are now directly participating as Internet nodes due to the usage of the Slip protocol. Tests with Teleman, the metropolitan high speed network of the Nijmegen area, showed that this network will allow cable-connected home PCs to communicate with the local network of the institute at high speed. It seems that from Spring 1995 the home PCs of an increasing number of staff members will be connected to this facility.

Hardware

The institute continued to buy new 486 and Pentium-based PCs, Power-MACs, and HP Unix workstations. Two Novell-servers are servicing about 100 PCs and MACs. Four fast UNIX servers (three HP 735/125) were bought and integrated into the local network, which can serve as compute and file servers for the PC, MAC, and about 40 workstations. After all these changes, the local network stabilized again

and is now running smoothly. The VAX-line was completely stopped in 1994 and the remaining older ULTRIX servers will be completely replaced in 1995. For the simulation with neural networks, the rendering tasks, and some calculations in the Neurocognition project (such as source modeling), even more CPU-power will be necessary. It has to be checked whether software like Codine/PVM can be used.

The institute also bought a TFT panel which can be used together with an overhead projector producing enough light to run demonstrations from PC, MAC, or Video sources. It offers true color and VGA resolution.

Software

With few exceptions, only window based software is supported in the institute. All important software and databases have been ported to UNIX. New versions of the major software packages have been implemented. Some converters have been added to handle different formats which facilitates data transfer between the various programs available. First tests with WWW/Mosaic to build our own server for in-house information distribution were very successful. The general user interface and the hypertext language allows us to build up documents which can easily be used by even naive users.

Some new graphic and visualization tools were implemented. Besides IDL – which is efficiently used in the Neurocognition project and for the work with neural network based simulations – the institute now has S-Plus and Matlab licences. All three are very powerful visualization tools, each with their own special advantages. In the area of DTP, graphics, and image processing, new powerful software packages were installed to increase efficiency when producing scientific documents.

A special database for aphasic data was also implemented. It incorporates transcribed sentences from aphasic patients and various codings.

CELEX: The Center for Lexical Information

CELEX, the Dutch Center for Lexical Information, supports linguistic research and language-and-speech-oriented technological projects by providing lexical databases for Dutch, English and German, the hardware and software to access these data, and the expertise to apply the data and facilities. CELEX is a resource open to academic institutions in the Netherlands and abroad. The databases can be accessed interactively through the Dutch academic research network SURFnet, or queried in a stand-alone set-up on CD-ROM.

A five-year grant (running until 1998) from the Dutch Ministry of Science, Culture and Education will enable CELEX to continue its support to the Dutch academic world. The day-to-day administration of CELEX has been formally entrusted to the Max Planck Institute, which acts as one of four Dutch-based organizations supervising and assisting CELEX.

The greater part of 1994 was devoted to two activities. First of all, the conversion of the FLEX User Interface, lexical databases and user accounting software from VAX/VMS to UNIX was completed by H. Drexler, C. van der Veer and R. Piepenbrock in early March. In the same month, the revised database was opened to academic users. Work on fine-tuning access, adapting the set-up to various platforms and removing minor bugs continued until the end of the year. At the time of writing, the interactive version of the CELEX database is used by 87 academic researchers in the Netherlands and 15 more abroad.

Meanwhile, L. Gulikers continued the development of the German database, implementing the morphological decomposition scheme, assigning inflectional paradigm codes and verbal complementation labels, and adding frequent lemmas from the corpus provided by the Institut für Deutsche Sprache in Mannheim, Germany. A German release 2.5 is scheduled for early 1995. Tying in with these updates, Gulikers completed the German Linguistic Guide to appear as part of the CELEX User Guide.

The stand-alone version of CELEX on CD-ROM was distributed by the US-based Linguistic Data Consortium to over a hundred researchers at home and abroad. The lexical information on the CD is identical to the data accessed through FLEX, but the CD provides AWK and C-programs to facilitate the combination of fields from different files

and to access information about the orthographic, phonological, morphological, syntactic and frequency attributes of the words.

The F.C. Donders Lectures on Cognitive Neuroscience

In 1993, C. Brown and P. Hagoort initiated a lecture series on cognitive neuroscience. These F.C. Donders Lectures on Cognitive Neuroscience are given five times a year by outstanding representatives of central research areas in cognitive neuroscience. This lecture series is organized jointly with the Nijmegen Institute for Cognition and Information (NICI). The 1994 lecture series continued the success of the 1993 series, both in terms of the quality of the presentations and in terms of the attendance. Speakers in the 1994 series were: L. Weiskrantz (Oxford U.), G. Kostopoulos (U. Patras), B. Stein (Virginia Commonwealth U., Richmond), S. Zeki (U. College, London), and G. Mangun (U. California at Davis).

Internal Lectures and Colloquia

Colloquia organized by the Institute's Colloquium Committee (P. Hagoort and G. Senft) included lectures by E. Bates (U. California, San Diego), S. Glucksberg (Princeton U.), G. Kempen (U. Leiden), D. Norris (MRC Cambridge), K. Plunkett (Oxford U.), I. Sag (Stanford U.), P. Seuren (U. Nijmegen), D. Sperber (CREA, Ecole Polytechnique, and J. Tesak (U. Basel). Many informal lectures were also given by long-term and occasional visitors to the Institute.

Teaching

The staff of the Institute, the Cognitive Anthropology Research Group, and the Research Group on Structural Grammar (marked by an *) taught courses at the following summer schools and universities: Baayen (U. Geneva, Carouge); *Bierwisch (Humboldt U., Berlin); *Blutner (Humboldt U., Berlin); Bowerman (La Trobe University, Melbourne); *Dölling (Humboldt U., Berlin); Hagoort (U. Nijmegen); Indefrey (Heinrich-Heine-U., Düsseldorf); Levelt (1994 European Summer School on Cognitive Neuroscience, Nijmegen); Meyer (U. Nijmegen); Nuyts (U. Antwerp); Pederson (U. Leiden); Piepenbrock (CLS, Nijmegen); Senft (Technische U. Berlin); *Strigin (Humboldt U.,

Berlin); Vonk (U. Nijmegen; U. Nottingham); Wassenaar (U. Nijmegen); Weissenborn (U. Potsdam); *Wilder (Humboldt U., Berlin; U. Cologne; Olomouc, Czech Republic); Wilkins (SUNY, Buffalo); Wittenburg (U. Nijmegen).

Colloquia Presented

The following members of the Institute, the Cognitive Anthropology Research Group, the Research Group on Structural Grammar (marked by an *), and visitors (during their time at the Institute) presented colloquia at various institutions: Allen (Winnipeg MB); Baayen (Instituto di Psicologia del CNR, Rome; U. Nijmegen; U. Stuttgart); Behrens (Georgetown U., Washington D.C., U. Hamburg); v. Berkum (U. Illinois, Urbana-Champaign); *Blutner (U. Heidelberg); Bölte (Cognitive Science Lab, Binghamton); Bowerman (Brown U.); Brown (U. Tilburg); Cutler (U. Nijmegen; Joint MPI's Tübingen; Dokkyo U., Soka, Japan); Danziger (McGill U., Montreal, Canada); *Gärtner (U. Potsdam); Hagoort (U. Freiburg; U. Glasgow); Hall (U. Nijmegen; U. Paris X, Nanterre); Haviland (U. Illinois); (UCLA); Hoëm (U. Nijmegen); Kita (F.U. Berlin); Levelt (R. U. Limburg; U. Freiburg; Johns Hopkins U.); Levinson (MPI Tübingen); McQueen (U. Geneva; U. Tilburg); Meyer (Academisch Ziekenhuis, Nijmegen); Nuyts (U. Antwerp; Westfälische Wilhelms-U., Münster); *Ouhalla (Friedrich-Schiller-U., Jena; U. Geneve, December); Senft (U. Hamburg; Fachoberschule Xanten; Jugenddorf-Christopherusschule, Braunschweig; U. Papua New Guinea, Port Moresby; U. Nijmegen; U. Basel); *Strigin (IBM Heidelberg); v. Hout (U. Düsseldorf; Tilburg U.); Vonk (U. Leicester; U. Massachusetts, Amherst; U. Nottingham; U. Southern California, Marina del Rey; U. Southern California, Los Angeles; U. Massachusetts, Amherst); Wassenaar (U. Nijmegen); Weissenborn (U. Düsseldorf; Freie U. Berlin); *Wilder (U. Geneva; U. Potsdam); Wilkins (Brandeis U.; U. Köln); Wittenburg (TH Berlin; U. Potsdam); *Zimmermann (U. Berlin; U. Lund; U. Leipzig).

Workshops, Symposia, and Summer Schools Organized

S. Neumann and T. Widlok, in cooperation with the University of Botswana, organized a workshop on "Conceptions of space in language, cognition and social interaction in Southern Africa". The workshop was

held at the University of Botswana, Gaborone, on January 26-28.

In February, H. Behrens and H. Hendriks organized the annual symposium of the *Netwerk Eerste Taalverwerving* ('Network First Language Acquisition'), an organization of Dutch and Belgian first language acquisition researchers. In a total of eight papers, current research on the acquisition of Dutch was presented. Furthermore, Behrens and Hendriks compiled a bulletin on listing current acquisition research in The Netherlands and in Belgium.

On March 22-24, LAUD (Duisburg), IPrA (Antwerp), and the Cognitive Antropology Research Group organized a symposium on "Language and Space" held at Duisburg.

A. Meyer and A. Roelofs organized a workshop on "Syntax in language production". The workshop was held at Max Planck Institute on June 1-2. Presentations were given by K. Bock (U. Illinois), T. Pechmann (U. Saarbrücken), A. Meyer (MPI), G. Kempen (U. Leiden), J. van Berkum (MPI), H. Schriefers (F.U. Berlin), L. Wheeldon (U. Birmingham), M. Potter (MIT), K. De Smedt (U. Leiden), and W. Levelt (MPI).

Together with the Nijmegen Institute for Cognition and Information (NICI), C. Brown and P. Hagoort initiated and organized the first European Summer School on Cognitive Neuroscience. This 10-day summer school was held in Berg en Dal, from June 24 until July 4. The topics of the summer school were: (1) methods in cognitive neuroscience, (2) the visual system, (3) neural and cognitive plasticity, (4) memory, (5) attention and consciousness, (6) language, (7) history and perspectives. In addition, the program included two poster sessions where students presented their research, and an excursion to the Netherlands Institute for Brain Research, in Amsterdam. Lecturers were: A. Baddeley (MRC-APU, Cambridge), C. Brown (MPI), A. Coenen (NICI, U. Nijmegen), A. Cutler (MPI), A. Engel (MPI for Brain Research, Frankfurt), W. Gispen (Rudolf Magnus Institute, Utrecht), M. Goodale (U. Western Ontario), B. Gordon (Johns Hopkins, Baltimore), P. Hagoort (MPI), H. Kolk (NICI, U. Nijmegen), M. Kutas (U. California at San Diego), W. Levelt (MPI), G. Mangun (U. of California at Davis), J. Marshall (Radcliffe Infirmary, Oxford), M.

Mishkin (NIH, Bethesda), M. Rugg (Wellcome Brain Research Group, St. Andrews), D. Swaab (Netherlands Institute for Brain Research, Amsterdam), L. Wertheim (IZF-TNO, Soesterberg), R. Wise (MRC Cyclotron Unit, London), S. Zeki (University College, London). Fifty young researchers from different areas of cognitive neuroscience were selected as students from a large number of applicants. Participants came from 14 different European countries, including Israel. The summer school was sponsored by the NICI, The Max Planck Society, The European Brain and Behaviour Society (EBBS), and PSYCHON (NWO).

C. Wilder, in cooperation with G. Brugger (U. Vienna), A. Cardinaletti (U. Venice), D. Cavar (U. Potsdam), G. Guisti (U. Venice), A. Madeira (U. London), M. Schorlemmer (U. Utrecht), M. Starke (U. Geneva/Berlin) and L. Veselovska (U. Olomouc), organized the "Central European Summer School in Generative Syntax". The summer school was held in Olomouc, Czech Republic, from August 22 until September 3. There were no fees for the 70 students, and due to generous support from GLOW and the Soros Foundation, it was possible to offer 40 students from Eastern European countries a grant covering travel, board and accommodation (without which most would not have been able to attend). This event provided a uniquely affordable opportunity for students from across the world, and especially from eastern Europe, to gain an intensive education in current generative syntactic theory. Introductory and advanced courses were offered, and included material relevant to the study of Slavic languages.

C. Brown, P. Hagoort, and W. Vonk organized a one-day workshop on parsing. This workshop was held at the Max Planck Institute on September 23. Apart from the organizers, presentations were given by G. Altmann (U. Sussex), D. Mitchell (U. Exeter), B. Hemforth (U. Freiburg), L. Osterhout (U. Washington), and M. Brysbaert (U. Leuven).

Presentations at Conferences, Congresses, and Workshops

Allen, S., and Crago, M. "Acquisition of transitivity in Inuktitut". International Conference on Infant Studies. Paris, June.

Baayen, R. H. "Morphological productivity as function of text type and author". Joint International Conference of the Association for Literary and Linguistic Computing and the Association for Computing and the Humanities. Paris, April.

Baayen, R. H. "De verwerking van meervouden van ongelede nomina in het Nederlands". Annual Dutch-Flemish Morphology Meeting. Groningen, September.

Behrens, H. "The acquisition of present tense: A semantic problem?" 18th Boston University Conference on Language Development. Boston, January.

Behrens, H. "Cognition = concepts = semantics? Theoretical issues in the study of temporal reference". NELAS 3 (Northern European Language Acquisition Society). Reykjavik, July.

Behrens, H. "William Stern und die Spracherwerbsforschung". 39. Kongreß der Deutschen Gesellschaft für Psychologie. Hamburg, September.

Behrens, H. "The acquisition of tense marking in German". Dutch-German Colloquium on Language Acquisition. Groningen, September.

Bickel, B. "Sur la typologie de la proposition relative en Himalaya: La construction circumnominale en bélharien". 27th International Conference on Sino-Tibetan languages and linguistics. Paris, October.

*Bierwisch, M. "Die Auflösung der Universalgrammatik--Minimalismus als kognitives Programm". Colloquium 'Kognition und Textverstehen'. Berlin, January.

*Bierwisch, M. "Über den Inhalt syntaktischer Kategorien". 16. Jahrestagung der Deutschen Gesellschaft für Sprachwissenschaft. Münster, March.

*Bierwisch, M. "Recruiting spatial vocabulary". Conference on Language and Space. Tucson, March.

*Bierwisch, M. "On the semantic form of lexical entries". Sixth European Summer School in logic, language and information. Copenhagen, August.

*Blutner, R. "Polysemie und Abduktion". Arbeitstreffen Semantisches und konzeptuelles Wissen. Berlin, April.

*Blutner, R. "Kognition und Lexikon: Zur Interpretation polysemer Institutionswörter". Erste Fachtagung der Gesellschaft für Kognitionswissenschaft. Freiburg, October.

Bölte, J. "Aktivieren Pseudowörter lexikalische Einträge im mentalen Lexikon – oder – Was kommt einem in den Sinn, wenn man Domate hört". 36. Tagung experimentell arbeitender Psychologen und Psychologinnen. München, März.

Bölte, J. "The role of mismatching information in spoken word recognition". 35th Annual Meeting of the Psychonomic Society. St. Louis, November.

Bolwiender, A., and Drews, E. "The processing of Dutch and German simple and complex verbs". Tagung des Schwerpunktes Kognitive Linguistik. Freiburg, November.

Bowerman, M., and Choi, S. "Linguistic and nonlinguistic determinants of spatial semantic development; A cross-linguistic study of English, Korean, and Dutch". 18th Boston University Conference on Language Development. Boston, January.

Bowerman, M. "Constructing categories of spatial action in English, Dutch, and Korean". Conference 'Language and space'. Arizona, March.

Bowerman, M. "Universal and language specific in early grammatical development". Discussion meeting 'The acquisition and dissolution of language'. London, March.

Bowerman, M. "Constructing spatial categories in Korean, Dutch, and English: How are learners influenced by the adult semantic system?" 26th Annual Stanford Child Language Research Forum. Stanford, April.

Bowerman, M. "Studying semantic development cross-linguistically: How do children learn to talk about space?" First Lisbon Meeting on Child Language. Lisbon, June.

Bowerman, M. "Dividing up space: Cross-linguistic perspectives on the acquisition of spatial semantic categories". Keynote address: Eighth Australasian Human Development Conference. Melbourne, July.

Brown, C. "The neural reality of syntax". European Summer School on Cognitive Neuroscience. Berg en Dal, The Netherlands, July.

Brown, C. "What ERPs reveal about the nature of language

comprehension deficits in aphasia". Conference on Mapping Cognition in Time and Space: Combining EEG, MEG, with Functional Imaging. Magdeburg, July.

Brown, P. "How Tzeltal children learn to talk about space". Vrijdagclub, Linguistics Faculty. Amsterdam, December.

Brown, P. "How Tzeltal children learn to refer to shape and location: A preliminary report". 19th LAUD Conference. Duisburg, March.

Brugman, H. "A media tagger for gesture analysis". UCI Multi-Media Colloquium. Nijmegen, April.

Chen, H.-C. "Chinese reading". International Conference on Chinese psychology. Hong Kong, June.

Chen, H.-C. "Parsing in Chinese: Some psychological studies". Third International Conference on Chinese Linguistics. Hong Kong, July.

Chen, H.-C. "Comprehension processes in reading Chinese". 35th Annual Meeting of the Psychonomic Society meeting. St. Louis, November.

Chen, H.-C., Flores d'Arcais, G.B., and Cheung, S.-L. "Is phonological activation automatic in character recognition in Chinese"? Asian-Australian Workshop on Cognitive Processing of Asian Languages. Sydney, December.

Cutler, A. "Language-specific listening". XII Congreso Anual de la Asociacion Espanola de Linguistique Applicada. Barcelona, April.

Cutler, A. "Future trends for research in human spoken-language processing". Third International Conference on Spoken Language Processing. Yokohama, September.

Cutler, A. "What defines the English stress unit?" 12th National Conference, English Linguistic Society of Japan. Tokyo, November.

Cutler, A. "Psycholinguistic approaches to spoken-word recognition". Fifth Australian International Conference on Speech Science and Technology. Perth, December.

Cutler, A., McQueen, J., Baayen, R. H., Roach, P., and Drexler, H. "Words within words in a real-speech corpus". Fifth Australian International Conference on Speech Science and Technology. Perth, December.

Cutler, A., McQueen, J., Baayen, R. H., Roach, P., and Drexler, H.

"Testing models of spoken word recognition against real speech". Fourth Workshop on Language Comprehension. Hyeres, France, May.

Cutler, A., McQueen, J., Briscoe, E. J., and Norris, D. G. "Constraints of vocabulary structure on models of spoken word recognition". Annual meeting, Joint Councils Initiative in Cognitive Science and Human-Computer Interaction. Brighton, April.

Danziger, E., Inoue, K., Kita, S., Levy, P., Pederson, E., and Wilkins, D. "Cultural variation in spatial conceptualization". Workshop on The Ontology of Space, First International Summer Institute in Cognitive Science. Buffalo NY, July.

*Dölling, J. "Appellativa: Semantische Repräsentation vs. konzeptueller Gehalt". Colloquium on 'Semantisches und konzeptuelles Wissen'. Berlin, April.

*Dölling, J. "Lexikalische Einträge und Regeln für Nomen". International Workshop on 'Lexikologie und lexikalische Semantik'. Münster, September.

*Dölling, J. "Bedeutungsvariationen und lexikalische Nominalstruktur". KONVENS '94 'Verarbeitung natürlicher Sprache'. Wien, September.

Dronkers, N., Wilkins, D., Van Valin, R., Redfern, B., and Jaeger, J. "Neural mechanisms of morphosyntactic comprehension deficits". Inaugural meeting of the Cognitive Neuroscience Society. San Francisco, March.

Dronkers, N., Wilkins, D., Van Valin, R., Redfern, B. and Jaeger, J. "A reconsideration of the brain areas involved in the disruption of morphsyntactic comprehension". Academy of Aphasia Annual Meeting. Boston, October.

Frazier, L. "Models of sentence processing". C.R.E.P.C.O. Aix-en-Provence, November.

Flores d'Arcais, G. B. "The bilingual lexicon". First Symposium on Brain and Language, European Academy. Bolzano, August.

Flores d'Arcais, G. B. "The comprehension of Italian clitics in adults and children". Eighth Conference of the European Society of Cognitive Psychology. Lisboa, September.

Flores d'Arcais, G. B. "Ergonomic aspects of information presentation". Fourth Congress on the Psychology of Tourism. Trento, September.

Flores d'Arcais, G. B. "La comprensione e produzione di parole

composte in italiano". 13th Congress of the Italian Experimental Psychology Division. Padova, September.

Flores d'Arcais, G. B. "I confini tra i processi mentali". First Congress of the Italian Psychological Association (A.P.I.). Padova, September.

*Gärtner, H.-M. "Generalized transformations and relative classes". Grammatikseminar der 'Institutionen für Nordiska Sprak'. Lund, December.

Goebel, R, and Indefrey, P. "The performance of a recurrent network with short term memory capacity learning the German s-plural". Workshop 'Cognitive Models of Language Acquisition'. Tilburg, February.

Hagoort, P. "On the nature of lexical-semantic processing impairments in aphasia". TENNET V. Montréal, May.

Hagoort, P. "Agrammatic aphasia as an interface between the cognitive and the neural architecture of language". European Summer School on Cognitive Neuroscience. Berg en Dal, The Netherlands, July.

Hagoort, P. "ERPs and language". Workshop on Event-Related Potentials and Cognition. Nijmegen, July.

Hagoort, P. "The Syntactic Positive Shift (SPS) as the brain's response to syntactic processing". Seventh International Congress of Psychophysiology of the International Organization of Psychophysiology (IOP). Porto Carras, Greece, September.

Hagoort P. "Hoe heet zoiets ook alweer?". Evening on the mental lexicon, organized by Werkverband Amsterdamse Psycholinguïsten. Amsterdam, November.

Hall, T. A. "Sibilant neutralization in Gujarati". International Workshop on Phonological Structure. Durham, England. September.

Heeschen, C. "Interaktionale Motivation adaptiver Strategien bei Aphatikern". Tagung des Deutschen Bundesverbandes für Logopädie. Mainz, May.

Hendriks, H. "A crosslinguistic study on the setting of spatial frames in children's narratives". 13th biennial meetings of ISSBD. Amsterdam, June.

Hendriks, H. "Embedding utterances in discourse: a comparative study of Chinese and Dutch". Sixth symposium Netwerk Eerste Taalverwerving. Nijmegen, February.

Hendriks, H., Hickmann, M., and Liang, J.C.P. "The uses of

temporal-aspectual devices by Chinese children: semantic and discourse determinants". Third International Conference on Chinese Linguistics. Hong Kong, July.

Hickmann, M., Roland, F., and Hendriks, H. "Spatial reference in French children's narratives: A crosslinguistic perspective". First Lisbon Meeting on Child Language, Panel on "Narratives by Children". Lisbon, June.

Hickmann, M., Roland, F., and Löbach, B. "How children narrate motion events": a comparative study of French, English, and German. 13th biennial meetings of ISSBD. Amsterdam, June.

Hill, D. "Distinguishing the notion PLACE in Oceanic languages". 19th LAUD Conference. Duisburg, March.

Hill, D. "Object incorporation and related constructions in Longgu (Solomon Islands)". Seventh ICAL conference. Leiden, August.

Hoëm, I. "Discourse and social context". Seventh ICAL conference. Leiden, August.

Hoëm, I. "Staging a political challenge; The story of Tokelau te Ata". Seminar 'Memory and Social Transmission'. Queens University of Belfast, September.

Hollebrandse, B., and van Hout, A. "Light verb learning in Dutch". Dutch-German Colloquium on Language Acquisition. Groningen, September.

Hustinx, L.G.M.M., and Vonk, W. "The qualification function of demonstrative noun anaphora". Dandelion Workshop. Madrid, July.

Indefrey, P., Brown, C., Hagoort, P., and Seitz, R.J. "The reading of words and legal nonwords: Preliminary findings". European Summer School on Cognitive Neuroscience. Berg en Dal, The Netherlands, July.

Inoue, K. "Dynamic space in Japanese compound verbs". 19th LAUD Conference. Duisburg, March.

Inoue, K. "Fuhen to soutai no hazamade: Bunka wa gengo to ninchi o sayuu suru ka (In between universality and relativity: Will culture determine language and cognition?)". Mejiro Linguistic Society. Tokyo, July.

Jordens, P. "Acquisition of extraction in SLA". 16. Jahrestagung der Deutschen Gesellschaft für Sprachwissenschaft. Münster, March.

Jordens, P. "Subjacency and learnability". Fourth ISAPL Congress.

Bologna and Cesena, June.

Kita, S. "Syntactic toybox: the structure of NP's with *same*". The 30th Chicago Linguistic Society. Chicago, April.

Kita, S., McNeill, D., Pedelty, L., and McCullough, K.E. "Brain and gesture". 23rd International Congress of Applied Psychology. Madrid, July.

Kuijk, D. van, and Wittenburg, P. "RAW: a new model of human word recognition". Second International Conference on Social Science Information Technology. Amsterdam, December.

Lasser, I. "Triggering functional projections: The role of inflectional affixes". Dutch-German Colloquium on Language Acquisition. Groningen, September.

Lasser, I. "Optionally raised verbs in child language". 18th Annual Meeting of the Atlantic Provinces Linguistic Association. St. John, October.

Levelt, W. J. M. "Perspective taking and ellipsis in spatial expressions". Conference on Language and Space. Tucson, March.

Levelt, W. J. M. "Bouma on reading". Symposium Human Interface: Perception, Knowledge, Action. Eindhoven, March.

Levelt, W. J. M. "How do we produce words when we speak? Lexical access in a theory of speech production" The Sixth Annual Fred Attneave Memorial Lecture. Oregon, May.

Levelt, W. J. M. "Onder woorden brengen. Beschouwingen over het spreekproces". Jaarvergadering Hollandsche Maatschappij van Wetenschappen. Haarlem, May.

Levelt, W. J. M. and Ruijssenaars, W. "Johan Joseph Dumont 1935 – 1994. Levensbericht". Koninklijke Nederlandse Akademie van Wetenschappen. Amsterdam, June.

Levelt, W. J. M. "On the skill of speaking: How do we access words?" Third International Conference on Spoken Language Processing. Yokohama, September.

Levelt, W. J. M. "What can a theory of normal speaking contribute to AAC?" Opening lecture. Sixth Biennial Conference of the International Society for Augmentative and Alternative Communication. Maastricht, October.

Levinson, S. "Frames of reference and Molyneux's question". Conference on Language and Space. Tucson, March.

Levinson, S. "Language and spatial conception". 19th LAUD

Conference. Duisburg, March.

McQueen, J.M. "Do ambiguous fricatives rhyme? Lexical involvement in phonetic decision-making depends on task demands". Third International Conference on Spoken Language Processing. Yokohama, September.

McQueen, J.M. "The role of prosody in human speech recognition". Eighth Twente Workshop on Language Technology: Speech and Language Engineering. Enschede, December.

Meijer, P. J. A. "Towards a new model of phonological encoding". 16th Annual Conference of the Cognitive Society. Atlanta, August.

Meyer, A. "The time course of phonological encoding of phrases and sentences". Seventh Conference of the European Society for Cognitive Psychology. Lisbon, September.

Meyer, A. "Phonologische und artikulatorische Einflüsse auf den Sprachrhythmus". 39. Kongress der deutschen Gesellschaft für Psychologie. Hamburg, September.

Meyer, A. "Zugang zum mentalen Lexikon in der Sprachproduktion". KONVENS. Wien, September.

Meyer, A. "Phonological encoding of phrases and sentences". 35th Annual Meeting of the Psychonomic Society. St. Louis, November.

Meyer, A. and Parqui, J. "Inkrementelle Produktion von Phrasen und Saetzen: Ergebnisse von Bild-Wort-Interferenz-Experimenten". 36. Tagung experimentell arbeitender Psychologen und Psychologinnen. München, March.

Neumann, S. and Widlok, T. "Spatial language in regional comparison". 19th LAUD Conference. Duisburg, March.

Noordman, L. G. M. and Vonk, W. "Towards a more parsimonious theory of inferences". Seventh Conference of the European Society for Cognitive Psychology. Lisbon, September.

Noordman, L.G.M. and Vonk, W. "Some psycholinguistic reflections on NL-Soar and text comprehension". Euro-Soar 8. Leiden, November.

Nuyts, J. and De Roeck, A. "Epistemic modal expressions by high functioning autistic adults: A test case for the 'theory of mind' hypothesis". The National Autistic Society conference on 'Autism on the Agenda'. Leeds, April.

Nuyts, J. "The meanings and uses of the mental state predicate think".

Sixth International Conference on Functional Grammar. York, August.

*Ouhalla, J. "The binding properties of wh-pronouns". Workshop Lexicon and Syntax'. Potsdam, December.

*Ouhalla, J. "Genitive subjects and the VSO order in Berber". Eurotyp Workshop on Word Order. Durham, November.

Pederson, E. "Intra-cultural negotiation of spatial reference systems". 19th LAUD Conference. Duisburg, March.

Penner, Z., Tracy, R. and Weissenborn, J. "Triggering object scrambling at the early stage in German and Bernese Swiss German". Workshop on the L1 and L2 acquisition of clause internal rules: Scrambling and Clitcization. Bern, January.

Penner, Z., Schönenberger, M. and Weissenborn, J. "Object placement in Early German". Workshop on the L1 and L2 acquisition of clause internal rules: Scrambling and Clitcization. Bern, January.

Penner, Z., and Weissenborn, J. "Strong continuity meets the input: On the acquisition of the DP in Bernese Swiss German and High German". Workshop on Generative Studies of the Acquisition of Case and Agreement. Colchester, March.

Randall, J., Hout, A. van, Weissenborn, J. and Baayen, H. "Approaching linking". 18th Boston University Conference on Language Development. Boston, January.

Randall, J., Hout, A. van, Weissenborn, J. and Baayen, H. "Acquiring HAVE and BE". Langues et Grammaire 1. Paris, June.

Roelofs, A. "On-line versus off-line priming of word-form encoding in spoken word production". 16th Annual Conference of the Cognitive Science Society. Atlanta, August.

Roelofs, A. "Word-form encoding in speaking: Segmental speech errors as failures of syllabary access". Seventh Conference of the European Society for Cognitive Psychology. Lisbon, Portugal, September.

Saito, H., Flores d'Arcais, G.B., Kawakami, M. and Amsuda, H. "Phonological factors in radical migration with kanji characters". Asian-Australian Workshop on Cognitive processing of Asian Languages. Sydney, December.

Schouten, C.H. and Vonk, W. "Gemarkeerd gebruik van indefiniete NP's in tekst". 17e Minisymposium over Lezen. Nijmegen, April.

Schouten, C.H. and Vonk, W. "Marked indefinite noun phrases and text type". Workshop Genre, Register, and Language. 21th International Systemic Functional Congress. Gent, August.

Schreuder, R. and Baayen, R. H. "Morphological processing: When, where, and why (not)". TENNET V. Quebec, May.

Senft, G. "Ein Vorschlag, wie man standardisiert Daten zum Thema 'Sprache, Kognition und Konzepte des Raumes' in verschiedenen Kulturen erheben kann". 11. Hamburger Kognitionskolloquium Räume". Hamburg, February.

Senft, G. "Ain't misbehavin...? Trobriand pragmatics and the field researcher's opportunity to put his foot in it". 29e Oceanistendag, Werkgemeenschap Zuid-Oost Azie en Oceanie. Nijmegen, April 4

Senft, G. "Audio-visual equipment in research on space". Multidisciplinair symposium 'Beeld in Onderzoek, onderzoek in beeld'. Rijksmuseum voor Volkenkunde Leiden. Leiden, May.

Senft, G. "Sprache, Kognition und Konzepte des Raumes in verschiedenen Sprachen und Kulturen". Antrittsvorlesung. Universität zu Köln. November.

Senft, G. "'Noble Savages' and 'the Islands of Love': Trobriand Islanders in 'popular publications'". Basel Conference of the European Society for Oceanists. Basel, December.

Slobin, D. I. "From universals to types: Focusing in on crosslinguistic differences in acquisition". First Lisbon Meeting on Child Language. Lisbon, Portugal, June.

Slobin, D. I. "A typological perspective on learning to talk about space". NELAS 3 (Northern European Language Acquisition Society). Reykjavik, July.

Slobin, D. I. "New perspectives on language and thought". Lecture in series "Fakultets Forsknings Fredage". Copenhagen, December.

Slobin, D. I. "Reference to movement in spoken and signed languages: Typological considerations". Lecture to Linguistics Circle. Copenhagen, December.

Starren, M. "Phenomenes de reduction linguistique dans une situation d'aquisition et d'attrition linguistique d'une langue seconde". Fourth EUROSLA (European Second language Acquisition Association) Conference. Aix-en-Provence, September.

Stolz, Ch. and Stolz, Th. "Hispano-Indiana. Sprachkontakt und

Grammatikalisierung in Meso-Amerika". 16. Jahrestagung der Deutschen Gesellschaft für Sprachwissenschaft. Münster, March.

Stolz, Ch. "The vertical dimension in Yucatec Maya and the search for semantic universals". 93rd Annual Meeting of the American Anthropological Association. Atlanta, December.

*Strigin, A. "Die semantische Form der Präposition 'mit'". Arbeitstreffen 'Semantisches und Konzeptuelles Wissen'. Berlin, April.

*Strigin, A. "Integrating syntax and semantics in the treatment of scope: Scrambling and topicalization in German". Fifth Logic and Language Colloquium. Noszwaj, Hungary, September.

Swaab, T.Y., Brown, C., and Hagoort, P. "Was ereigniskorrelierte potentiale aussagen über Sprachverständnisstörungen bei Aphasikern". 4. Rhein-Ruhr-Meeting. Bochum, May.

Turennout, M. van "The lateralized readiness potential as an index of semantic and phonological activation during speech production". European Summer School on Cognitive Neuroscience. Berg en Dal, The Netherlands, July.

Vonk, W. "On the processing of linguistically marked contrast relations". Seventh Conference of the European Society for Cognitive Psychology. Lisbon, September.

Vonk, W. "Referential expressions as discourse structuring devices". 25. Jahrestagung der Gesellschaft für angewandte Linguistik. Trier, September.

Weissenborn, J. and Haverkort, M. "On the acquisition of Romance and Germanic clitics". First Lisbon Meeting on Child Language. Lisbon, June.

Widlok, T. "An anthropologist looks at oral history". Symposion 'Writing history. Society and Identity in Namibia'. Hannover, May.

Widlok, T. "What happened to the Hai||om? Khoisan studies in Namibia's agropastoralist north". Conference on 'Khoisan Studies: Multidisciplinary Perspectives'. Tutzing/Lake Starnberg, July.

*Wilder, C. "ATB-Extraktion". 16. Jahrestagung der Deutschen Gesellschaft für Sprachwissenschaft. Münster, March.

*Wilder, C. "Bewegung, Koordination und Ellipse". Siebente Wuppertaler Linguistisches Kolloquium. Wuppertal, November.

*Wilder, C. "Rightward movement as leftward deletion". Workshop 'Lexicon and Syntax'. Potsdam, December.

Wilkins, D., and Senft, G. "A man, a tree, and forget about the pigs: Space games, spatial reference and an attempt to identify functional equivalents across languages". 19th LAUD Conference. Duisburg, March.

Wittenburg, P. "Artificial neural networks in psycholinguistic research". Second PATO course on Neural Networks and their Application. Enschede, November.

Wittenburg, P., and Harmelen, H. van "Self-organizing feature maps for sequences". 39. International Scientific Colloquium. Ilmenau, September.

*Zimmermann, I. "Zur Legitimierung syntaktischer Merkmale". 16. Jahrestagung der Deutschen Gesellschaft für Sprachwissenschaft. Münster, March.

*Zimmermann, I. "Die Satzeinleitung 'wie' in Satzadverbialphrasen". Netzwerk Sprache und Pragmatik. Rendsburg, September.

*Zimmermann, I. "Das relativische Pronominaladverb 'wie'". Siebente Wuppertaler Linguistisches Kolloquium. Wuppertal, November.

*Zimmermann, I. "Das syntaktische Merkmal ADV(erb)". Workshop 'Lexikalische Kategorien und Merkmale'. Köln, December.

Zwitserlood P. "Prozesse der visuellen Worterkennung". 25. Jahrestagung der Gesellschaft für angewandte Linguistik. Trier, September.

Publications

Au Yeung, L. H., and Chen, H.-C. (1994). Reading Chinese text: Effects of spacing and display layout. In Q. Jing, H. Zhang and D. Peng (Eds.), *Information processing of the Chinese language* (pp. 113-123). Beijing: Beijing Normal University Press.

Allen, S. (1994). *Acquisition of some mechanisms of transitivity alternation in arctic Quebec Inuktitut.* Doctoral dissertation. McGill University, Montreal.

Baayen, R. H. (1994). Derivational productivity and text typology. *Journal of Quantitative Linguistics, 1,* 16-34.

Baayen, R. H. (1994). Productivity in production. *Language and Cognitive Processes, 9,* 447-469.

Baayen, R. H. (1994). The randomness assumption in word frequency statistics. In K. Apt, L. Schrijver and N. Temme (Eds.), *From universal morphisms to megabytes: A Baayen space odyssey* (pp. 125-140). Amsterdam: Centre for Mathematics and Computer Science.

Berman, R. A., and Slobin, D. I. (1994). *Relating events in narrative: A crosslinguistic developmental study.* Hillsdale, NJ: Lawrence Erlbaum.

Bickel, B. (1994) Athpahariya jatikeho? (What is the Athpahariya caste?). *Jana Visvas Saptahik, 2/26,* 3-4.

*Bierwisch, M. (1994). Sprache als Berechnungssystem. Strukturelle Grammatik zwischen Geistes- und Naturwissenschaft. *MPG Spiegel, 2,* 18-23.

*Bierwisch, M. (1994). Les jeux sont faits: Linguistik in der "Informationsgesellschaft". In L. Jäger and B. Switalla (Eds.), *Germanistik in der Mediengesellschaft* (pp. 245-289). München: Wilhelm Fink Verlag.

*Bierwisch, M. (1994). Kommunizieren und Berechnen. Linguistik zwischen Biologie und Geisteswissenschaft. *Berlin-Brandenburgische Akademie der Wissenschaften: Jahrbuch 1992/93* (pp. 187-215). Berlin: Akademie Verlag

Blomert, L. (1994). *Assessment and recovery of verbal communication in aphasia.* Doctoral dissertation. Nijmegen University.

*Blutner, R. (1994). Kognition und Lexikon: Zur Interpretation

polysemer Institutionswörter. In K. Opwis (Ed.), *Proceedings der 1. Fachtagung der Gesellschaft für Kognitionswissenschaft* (pp. 10-12). Freiburg: Universität Freiburg.

Bock, K., and Levelt, W. J. M. (1994). Language production: Grammatical encoding. In M. A. Gernsbacher (Ed.), *Handbook of psycholinguistics* (pp. 945-984). London: Academic Press.

Bowerman, M. (1994). From universal to language-specific in early grammatical development. *Philosophical Transactions of the Royal Society of London, B, 346,* 37-45.

Bouman, M. A., and Levelt, W. J. M. (1994). Werner E. Reichardt. Levensbericht. *Levensberichten en herdenkingen 1993* (pp. 75-80). Amsterdam: Koninklijke Akademie van Wetenschappen.

Brown, P. (1994). The INs and ONs of Tzeltal locative expressions: The semantics of static descriptions of location. In J. B. Haviland and S. C. Levinson (Eds.), Spatial conceptualization in Mayan Languages. [Special Issue]. *Linguistics, 32,* 743-790.

Cavar, D., and *Wilder, C. (1994). Clitic Third in Croatian. *Linguistik in Potsdam, 1,* 25-63.

Chen, H.-C. (1994). Investigating the comprehension processes in reading Chinese text. In H. W. Chang, C. W. Hue, J. T. Huang and O. J. L. Tzeng (Eds.), *Advances in the study of Chinese language processing* (pp. 273-284). Taipei: National Taiwan University.

Chen, H.-C. (1994). Reading in Chinese: A cognitive analysis. In H. M. Lee, K. C. Ho, and S. K. Tse (Eds.), *Language and learning* (pp. 29-36). Hong Kong: HK Government Press.

Cutler, A. (1994). Segmentation problems, rhythmic solutions. *Lingua, 92,* 81-104.

Cutler, A. (1994). The perception of rhythm in language. *Cognition, 50,* 79-81.

Cutler, A. (1994). How human speech recognition is affected by phonological diversity among languages. *Proceedings of the 5th Australian International Conference on Speech Science and Technology, I* (pp. 285-288). Perth: Australian Speech Science and Technology Association.

Cutler, A., McQueen, J., Baayen, H. and Drexler, H. (1994). Words within words in a real-speech corpus. *Proceedings of the 5th Australian International Conference on Speech Science and*

Technology, I (pp. 362-367). Perth: Australian Speech Science and Technology Association.

Cutler, A., Norris, D., and McQueen, J. (1994). Modelling lexical access from continuous speech input. *Dokkyo International Review, 7* (pp. 193-215). Tokyo: Dokkyo University.

Cutler, A., and Otake, T. (1994). Mora or phoneme? Further evidence for language-specific listening. *Journal of Memory and Language, 33,* 824-844.

Cutler, A., and Young, D. (1994). Rhythmic structure of word blends in English. *International Conference on Spoken Language Processing 1994* (pp. 1407-1410). Yokohama: The Acoustical Society of Japan.

Danziger, E. (1994). Out of sight, out of mind: Person, perception and function in Mopan Maya spatial deixis. In J. B. Haviland and S.C. Levinson (Eds.), Spatial conceptualization in Mayan Languages. [Special Issue]. *Linguistics, 32,* 885-907.

Danziger, E. (1994). Review of J. Lucy (Ed.), *Reflexive language: Reported speech and metapragmatics* (Cambrige: Cambridge University Press, 1993). *Journal of Linguistic Anthropology, 4,* 228-231.

*Dölling, J. (1994). Sortale Selektionsbeschränkungen und systematische Bedeutungsvariationen. In M. Schwarz (Ed.), *Kognitive Semantik - Cognitive Semantics. Ergebnisse, Probleme, Perspektiven* (pp. 41-59). Tübingen: Narr.

*Dölling, J. (1994). Bedeutungsvariationen und lexikalische Nominalstruktur. In H. Trost (Ed.), **KONVENS '94. Verarbeitung natürlicher Sprache* (pp. 82-91). Berlin: Springer.

Dronkers, N. F., Wilkins, D. P., Van Valin, R. D., Redfern, B. B., and Jaeger, J. J. (1994). Abstract: A reconsideration of the brain areas involved in the disruption of morphsyntactic comprehension. *Brain and Language, 47,* 461-463.

Eling, P. (Ed.) (1994), *Reader in the history of aphasia.* Amsterdam: John Benjamins.

Flores d'Arcais, G. B. (1994). Architettura della mente e scienze cognitive. *Annuario dell'Università di Padova, 1993-94* (pp. 31-48). Padova: Università di Padova.

Flores d'Arcais, (G. B. 1994). Order of stroke writing as retrieval cue in the recognition of Chinese characters. *European Journal of Cognitive Psychology, 6,* 337-335.

Flores d'Arcais, G. B., Saito, H., Kawakami, M., and Masuda, H. (1994). Figural and phonological effects in radical migration with kanji characters. In H. W. Chang, C. W. Hue, J. T. Huang and O. J. L. Tzeng (Eds.), *Advances in the study of Chinese language processing* (pp. 241-254). Taipei: National Taiwan University.

Flores d'Arcais, G. B. (1994). Il linguaggio. In P. Legrenzi (Ed.), *Manuale di Psicologia Generale* (pp. 336-392). Bologna: Il Mulino.

Gaskins, S. (1994). Integrating interpretive and quantitative methods in socialization research. *Merrill-Palmer Quarterly 40,* 313-333.

Grewendorf, G., and *Wilder, C. (1994). Universal Grammar in German and Scandinavian Linguistics. In C. Otero (Ed.), *Chomsky: Critical assessments. Vol. I: Linguistics* (pp. 784-817). New York: Routledge.

Hagoort, P. (1994). Het brein op een kier: Over hersenen gesproken. *Psychologie, 13,* 42-46.

Hagoort, P., and Brown, C. (1994). Brain responses to lexical ambiguity resolution and parsing. In C. Clifton, L. Frazier and K. Rayner (Eds.), *Perspectives on sentence processing* (pp. 45-81). Hillsdale, NJ: Lawrence Erlbaum.

Haviland, J. B. (1994). Te xa setel xulem (The buzzards were circling): Categories of verbal roots in (Zinacantec) Tzotzil. In J. B. Haviland and S. C. Levinson (Eds.), Spatial conceptualization in Mayan Languages. [Special Issue]. *Linguistics, 32,* 691-741.

Haviland, J. B., and Levinson, S. C. (Eds.), Spatial conceptualization in Mayan Languages. [Special Issue]. *Linguistics, 32.*

Heeschen, C., and Kolk, H. (1994). Adaptation bei Agrammatikern–interaktional motiviert? In I. M. Ohlendorf, T. A. Pollow, W. Widdig and D. B. Linke (Eds.) *Sprache und Gehirn. Festschrift zum 85. Geburtstag von A. Leischner* (pp. 123-136). Freiburg: Hochschul Verlag.

Heeschen, C. (1994). Some remarks on the prehistory of modularism in modern neuropsychology. An introduction to F. Gall. In P. Eling (Ed.) *Reader in the history of aphasia* (pp. 5-15). Amsterdam: John Benjamins.

Hickmann, M. (1994). Discourse organization and the development of reference to person, space, and time. In P. Fletcher and B. MacWhinney (Eds.) *Handbook of child language* (pp.

194-218). Oxford: Blackwell.

Hill, D. (1994). Longgu. In C. Goddard and A. Wierzbicka (Eds.) *Semantic and lexical universals* (pp. 311-329). Amsterdam: John Benjamins.

Indefrey, P. (1994). Theoretische Toleranz. Logische und methodologische Bemerkungen zu Peter Tepes "Theorie der Illusionen". In P. Tepe and M. Küppers (Eds.) *Mythologica 2, Düsseldorfer Jahrbuch für interdisziplinäre Mythosforschung* (pp. 135-157). Essen: Die blaue Eule.

Indefrey, P., and Baayen, H. (1994). Estimating word frequencies from lexical dispersion data. *Statistica Neerlandica, 48,* 259-270.

Inoue, K., and Stanlaw, J. (1994). Sapia sainyuumon: Part I: ima naze Sapia nanoka (Rethinking Sapir 1: Why Sapir now?). *Gengo, 23(1),* 94-99.

Inoue, K., and Stanlaw, J. (1994). Sapia sainyuumon: Part II: Sapia no gengoron (Rethinking Sapir 2: Sapir's linguistic theory). *Gengo, 23(2),* 92-97.

Inoue, K., and Stanlaw, J. (1994). Sapia sainyuumon: Part III: Bunka-jinruigakusha to shite no Sapia (Rethinking Sapir 3: Sapir as cultural anthropologist). *Gengo, 23(3),* 100-105.

Inoue, K., and Stanlaw, J. (1994). Sapia sainyuumon: Part IV: Sapia to amerika-genjuumingo (Rethinking Sapir 4: Sapir and native American linguistics). *Gengo, 23(4),* 97-103.

Inoue, K., and Stanlaw, J. (1994). Sapia sainyuumon: Part V: Sapia-woofu kasetsu (Rethinking Sapir 5: The Sapir-Whorf hypothesis). *Gengo, 23(5),* 101-106.

Inoue, K., and Stanlaw, J. (1994). Sapia sainyuumon: Part VI: Sapia-woofu kasetsu no yukue (Rethinking Sapir 6: The future of the Sapir-Whorf hypothesis). *Gengo, 23(6),* 98-103.

Inoue, K., and Stanlaw, J. (1994). Review of E. Clark, *Language and Linguistics* (Cambridge: Cambridge University Press, 1993). *Man, 29,* 1005-1007.

Jaarsveld, H. J. van, Coolen, R., and Schreuder, R. (1994). The role of analogy in the interpretation of novel compounds. *Journal of Psycholinguistic Research, 23,* 111-137.

Jescheniak, J.-D. (1994). *Word frequency effects in speech production.* Doctoral dissertation. Nijmegen University.

Jescheniak, J.-D., and Levelt, W. J. M. (1994). Word frequency effects in speech production: Retrieval of syntactic information and of

phonological form. *Journal of Experimental Psychology: Learning, Memory and Cognition, 20,* 824-843.

Jordens, P. (1994). Acquiring German and French in a bilingual setting. In J. M. Meisel (Ed.), *Bilingual first language acquisition. French and German grammatical development* (pp. 3-14). Amsterdam: John Benjamins.

Jordens, P. (1993). Het effect van taalaanbod en instructie op het talenonderwijs. *Toegepaste Taalwetenschap in Artikelen, 46/47,* 140-161.

Jordens, P., and Hoekstra, T. (1994). From adjunct to head. In T. Hoekstra and B. D. Schwartz (Eds.), *Language acquisition studies in generative grammar. Papers in honor of Kenneth Wexler from the 1991 GLOW workshops* (pp. 119-149). Amsterdam: John Benjamins.

Kita, S. (1994) Syntactic toybox: the structure of NPs with "same". In K. Beals, J. Denton, R. Knippen, L. Melnar, H. Suzuki and E. Zeinfeld (Eds.), *Papers from the 30th regional meeting of the Chicago Linguistic Society* (pp. 226-235). Chicago: Chicago Linguisti Society.

Klein, W. (1994). *Time in language.* London: Routledge.

Klein, W. (1994). Für eine rein zeitliche Deutung von Tempus und Aspekt. In R. Baum, K. Böckle, F. J. Hausmann and F. Lebsanft (Eds.), *Lingua et traditio. Geschichte der Sprachwissenschaft und der neueren Philologien* (pp. 409-422). Tübingen: Narr.

Klein, W. (1994). Learning how to express temporality in a second language. In *Società di linguistica Italiana, LI 34. Italiano – lingua seconda/lingua straniera. Atti del XXVI Congresso* (pp. 227-248). Roma: Bulzoni.

Klein, W. (1994). Ellipse. In J. Jacobs, A. v. Stechow, and T. Vennemann (Eds.), *Syntax. Ein internationales Handbuch zeitgenössischer Forschung. Vol. 1* (pp. 763-799). Berlin: de Gruyter.

Klein, W. (1994). Keine Känguruhs zur Linken – Über die Variabilität von Raumvorstellungen und ihren Ausdruck in der Sprache. In J.-J. Konradt, J. Grabowski and R. Mangold-Allwinn (Eds.), *Sprache und Kognition* (pp. 163-182). Heidelberg: Spektrum.

Klein, W., and Dittmar, N. (Eds.) (1994). Interkulturelle Kommunikation. [Special Issue]. *Lili: Zeitschrift für*

Literaturwissenschaft und Linguistik, 93.

Lasser, I. (1994). What the parser needs to know in order to attach a phrase. In J. Bayer (Ed.), Sentence processing and the nature of the human syntactic parser. [Special Issue]. *Folia Linguistica, 28,* 28-67.

de León, L. (1994). Exploration in the acquisition of location and trajectory in Tzotzil. In J. B. Haviland and S. C. Levinson (Eds.), Spatial conceptualization in Mayan Languages. [Special Issue]. *Linguistics, 32,* 857-884.

Levelt, W. J. M. (1994). The skill of speaking. In P. Bertelson, P. Eelen and G. d'Ydewalle (Eds.), *International perspectives on psychological science. Vol. I: Leading themes* (pp. 89-104). Hillsdale: Lawrence Erlbaum.

Levelt, W. J. M. (1994). On the skill of speaking: How do we access words? *International Conference on Spoken Language Processing 1994* (pp. 2253-2258). Yokohama: The Acoustical Society of Japan.

Levelt, W. J. M. (1994). What can a theory of normal speaking contribute to AAC? *ISAAC '94 Conference Book and Proceedings* (pp. 18-20). Hoensbroek: IRV.

Levelt, W. J. M. (1994). Hoofdstukken uit de psychologie. *Nederlands Tijdschrift voor de Psychologie, 49,* 1-14.

Levelt, W. J. M. (1994). *Onder woorden brengen: Beschouwingen over het spreekproces.* Haarlem: Hollandsche Maatschappij van Wetenschappen.

Levelt, W. J. M. and Wheeldon, L. (1994). Do speakers have access to a mental syllabary? *Cognition, 50,* 239-269.

Levinson, S. C., and Brown, P. (1994). Immanuel Kant among the Tenejapans: Anthropology as empirical philosophy. *Ethos, 22,* 3-41.

Levinson, S. C., and Haviland, J. (1994). Introduction: Spatial conceptualization in Mayan languages. In J. B. Haviland and S. C. Levinson (Eds.), Spatial conceptualization in Mayan Languages. [Special Issue]. *Linguistics, 32,* 613-622.

Levinson, S. C. (1994). Vision, shape and linguistic description: Tzeltal body-part terminology and object description. In J. B. Haviland and S. C. Levinson (Eds.), Spatial conceptualization in Mayan Languages. [Special issue]. *Linguistics, 32,* 791-856.

Levinson, S. C. (1994). Deixis. In R. E. Asher (ed.), *Encyclopedia of*

Language and Linguistics, Vol. 2 (pp. 853-857). Oxford: Pergamon. Press.

Lucy, J. (1994). The role of semantic value in lexical comparison: Motion and position roots in Yucatec Maya. In J.B. Haviland and S. C. Levinson (Eds.), Spatial conceptualization in Mayan Languages. [Special Issue]. *Linguistics, 32,* 623-656.

McQueen, J. M. (1994). Review of Y. Tohkura, E. Vatikiotis-Bateson and Y. Sagisaka (Eds.), *Speech perception, production and linguistic structure* (Amsterdam: IOS Press, 1992). *Quarterly Journal of Experimental Psychology, 47A,* 522-523.

McQueen, J. M. (1994). The role of prosody in human speech recognition. *Proceedings of Twente Workshop on Language Technology, 8,* (pp. 25-30). Enschede: University of Twente.

McQueen, J. M. (1994). Do ambiguous fricatives rhyme? Lexical involvement in phonetic decision-making depends on task demands. *International Conference on Spoken Language Processing 1994* (pp. 1139-1142). Yokohama: Acoustical Society of Japan.

McQueen, J. M., Norris, D., and Cutler, A. (1994). Competition in spoken word recognition: Spotting words in other words. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20,* 621-638.

Meijer, P. J. A. (1994). *Phonological encoding: The role of suprasegmental structures.* Doctoral dissertation. Nijmegen University.

Meyer, A. S. (1994). Timing in sentence production. *Journal of Memory and Language, 33,* 471-492.

Meyer, A. S. (1994). Zugang zum mentalen Lexikon in der Sprachproduktion. In H. Trost (Ed.), *KONVENS '94. Verarbeitung natürlicher Sprache* (pp. 1-2). Berlin: Springer.

Noordman, L. G. M., and Vonk, W. (1994). Text processing and its relevance for literacy. In L. Verhoeven (Ed.), *Functional literacy: Theoretical issues and educational implications* (pp. 75-93). Amsterdam: Benjamins.

Norris, D., McQueen, J., and Cutler, A. (1994). Competition and segmentation in spoken word recognition. *International Conference on Spoken Language Processing 1994* (pp. 71-74). Yokohama: Acoustical Society of Japan.

Nuyts, J. (1994). The intentional and the socio-cultural in language use.

Pragmatics and Cognition, 2, 237-268.

Nuyts, J., and Dendale, P. (1994). Bibliographie sélective de l'évidentialité. *Langue française, 102,* 121-125.

Nuyts, J. (1994). Autonomous vs. non-autonomous syntax. In J. Verschueren, J.-O. Östman and J. Blommaert (Eds.), *IPrA Handbook of pragmatics* (pp. 80-85). Amsterdam: Benjamins.

Nuyts, J. (1994). Functionalism vs. formalism. In J. Verschueren, J.-O. Östman and J. Blommaert (Eds.), *IPrA Handbook of pragmatics* (pp. 293-300). Amsterdam: Benjamins.

Nuyts, J. (1994). Mentalism. In J. Verschueren, J.-O. Östman and J. Blommaert (Eds.), *IPrA Handbook of pragmatics* (pp. 361-366). Amsterdam: Benjamins.

Ouhalla, J. (1994). Verb movement and word order in Arabic. In D. Lightfoot and N. Hornstein (Eds.) *Verb Movement* (pp. 41-72). Cambridge: Cambridge University Press.

Ouhalla, J. (1994). Focus in Standard Arabic. *Linguistik in Potsdam, 1,* 65-92.

Penner, Z., Schönenberger, M., and Weissenborn, J. (1994). The acquisition of object placement in early German and Swiss German. *Linguistik in Potsdam, 1,* 93-108.

Plesser, Th., Wittenburg, P. (1994). *Forschung und wissenschaftliches Rechnen.* Max-Planck-Gesellschaft, Berichte und Mitteilungen, Heft 1/94. München: Max-Planck-Gesellschaft.

Praamstra, P., Meyer, A. S., and Levelt, W. J. M. (1994). Neurophysiological manifestations of auditory phonological processing: Latency variation of a negative ERP component timelocked to phonological mismatch. *Journal of Cognitive Neuroscience, 6,* 204-219.

Roelofs, A. (1994). On-line versus off-line priming of word-form encoding in spoken word production. In A. Ram and K. Eiselt (Eds.), *Proceedings of the Sixteenth Annual Conference of the Cognitive Science Society* (pp. 772-777). Hillsdale, NJ: Lawrence Erlbaum.

Saito, H., Kawakami. M. and Flores d'Arcais, G. B. (1994). Radical migration in kanji recognition. (In Japanese). *Proceedings of the 10 Annual Meeting of the Japanese Cognitive Society, 1993* (pp. 88-89). Tokyo: Japanese Cognitive Society Publications.

Schreuder, R., and Baayen, R. H. (1994). Prefix-stripping re-revisited. *Journal of Memory and Language, 33,* 357-375.

Senft, G. (1994). These 'Procrustean' feelings... some of my problems in describing Kilivila. In G. Reesink (Ed.), *Topics in descriptive Austronesian linguistics. Semaian 11,* (pp. 87-105). Leiden: Vakgroep Talen en culturen van Zuidoost-Azie en Oceanie.

Senft, G. (1994). Spatial reference in Kilivila: The Tinkertoy matching games – A case study. *Language and Linguistics in Melanesia, 25,* 55-93.

Senft, G. (1994). Grammaticalization of body-part terms in Kilivila. *Language and Linguistics in Melanesia, 25,* 98-99.

Senft, G. (1994). Review of Z. Salzmann, *Language, culture and society: An introduction to linguistic anthropology* (Oxford: Westview, 1993). *Man, 29,* 756-757.

Senft, G. (1994). Elicitation. In J. Verschueren, J.-O. Östman and J. Blommaert (Eds.), *IPrA Handbook of pragmatics* (pp. 577-581). Amsterdam: Benjamins.

Senft, G. (1994). Fieldwork. In J. Verschueren, J.-O. Östman and J. Blommaert (Eds.), *IPrA Handbook of pragmatics* (pp. 595-601). Amsterdam: Benjamins.

Senft, G. (1994). Ein Vorschlag, wie man standardisiert Daten zum Thema 'Sprache, Kognition und Konzeption des Raums' in verschiedenen Kulturen erheben kann. *Linguistische Berichte, 154,* 413-429.

Senft, G. (1994). Darum gehet hin und lehret alle Völker... Mission, Kultur- und Sprachwandel am Beispiel der Trobriand-Insulaner von Papua-Neuguinea. In P. Stüben (Ed.), *Seelenfischer Mission, Stammesvölker und Ökologie. ökozid extra 4* (pp. 71-91). Gießen: Focus.

Slobin, D.I. (1994). Passives and alternatives in children's narratives in English, Spanish, German, and Turkish. In B. Fox and P. J. Hopper (Eds.), *Voice: Form and function* (pp. 341-364). Amsterdam: John Benjamins.

Slobin, D. I. (1994). Talking perfectly: Discourse origins of the present perfect. In W. Pagliuca and G. Davis (Eds.), *Perspectives on grammaticalization* (pp. 119-133). Amsterdam: John Benjamins.

*Strigin, A. (1994). Topicalization, scrambling and argument scope in German: Integrating semantic and syntactic information. *Journal of Semantics, 11,* 311-363.

Van Valin, R. (1994). Functional relations. In R. E. Asher (Ed.), *The encyclopedia of language & linguistics* (pp. 1327-1338). New York: Pergamon Press.

Van Valin, R. (1994) Extraction restrictions, competing theories and the argument from the poverty of the stimulus. In S. Lima, et al. (Eds.), *The reality of linguistic rules* (pp. 243-259). Amsterdam: John Benjamins.

Van Valin, R. (1994). Review of J. Grimshaw, *Argument structure* (Cambridge, MA: MIT Press, 1990). *Minds and Machines, 4,* 108-112.

Wassmann, J. (1994). The Yupno as post-Newtonian scientists: The question of what is 'natural' in spatial description. *Man, 29,* 645-666.

Weissenborn, J. (1994) Constraining the child's grammar: Local wellformedness in the development of verb movement in German and French. In B. Lust, J. Whitman and J. Kornfilt (Eds.), *Syntactic theory and language acquisition: Crosslinguistic perspectives. Vol.1: Phrase structure* (pp. 215-247). Hillsdale, N.J.: Lawrence Erlbaum.

Widlok, T. (1994). Space and the Other. Social experience and ethnography in the Kalahari Debate. In K. Hastrup and P. Hervik (Eds.), *Social experience and anthropological knowledge* (pp. 180-199). London: Routledge.

Widlok, T. (1994). Review of P. Miracle et al. (Eds.), *Foragers in Context* (Ann Arbor: University of Michigan, 1991). *Man, 29,* 523-524.

Widlok, T (1994). The social relationships of changing Haillom hunter-gatherers in Northern Namibia, 1990-1994. Doctoral dissertation. London School of Economics and Political Science.

*Wilder, C. (1994). Small Clauses im Englischen und in der GB-Theorie. In A. Steube (Ed.), *Zur Satzartigkeit von Infinitiven und Small Clauses* (pp. 219-241). Tübingen: Niemeyer.

*Wilder, C. (1994). Coordination, ATB and Ellipsis. In C. J.-W. Zwart (Ed.), *Minimalism and Kayne's Asymmetry Hypothesis* (pp. 291-329). Groningen.

*Wilder, C., and Cavar, D. (1994). Long head movement? Verb movement and cliticization in Croatian. *Lingua, 93,* 1-58.

*Wilder, C., and Cavar, D. (1994). Word order variation, verb movement and economy principles. *Studia Linguistica, 48,* 46-86.

*Wilder, C., and Cavar, D. (1994). Xø-Bewegung und Ökonomie. In B. Haftka (Ed.), *Was determiniert die Wortstellungsvariation? Studien zu einem Interaktionsfeld von Grammatik, Pragmatik und Sprachtypologie* (pp. 11-32). Opladen: Westdeutscher Verlag.

Wilkins, D. P., and J. Harkins (1994). Mparntwe Arrernte and the Search for Lexical Universals. In C. Goddard and A.Wierzbicka (Eds.), *Semantic and lexical universals* (pp. 285-310). Amsterdam: John Benjamins.

Wilkins, D. P. (1994). An alternative perspective on the relation between 'Arrernte Law' and 'Catholic Law'. *Oceania Newsletter, 14,* 7-10.

*Zimmermann, I. (1994). Review of V. Ehrich and H. Vater (Eds.), *Temporalsemantik. Beiträge zur Linguistik der Zeitreferenz* (Tübingen: Niemeyer, 1988). *Zeitschrift für Germanistik, 1,* 218-221.

Zwitserlood, P. (1994). Processing and representation of Dutch compounds: Effects of semantic transparency. *Language and Cognitive Processes, 9,* 341-368.

Zwitserlood, P. (1994). Access to phonological from representations in language comprehension and production. In C. Clifton, L. Frazier and K. Rayner (Eds.), *Perspectives on sentence processing* (pp. 83-106). Hillsdale, NJ: Lawrence Erlbaum.

Index of Names

Allen, S., 46, 49, 50
Baayen, H., 16, 19, 20, 30, 34, 41, 44, 133, 134, 135
Baumann, M., 32, 33
Behnke, K., 4
Behrens, H., 39, 54
Bennardo, G., 65
Berkum, J. van, 36
Bickel, B., 59, 60, 65, 68, 70, 74, 76
Bierwisch, M., 52, 125
Blutner, R., 127
Boland, J., 18, 19
Bölte, J., 17, 18
Bolwiender, A., 96
Boster, J., 80
Bowerman, M., 47, 65, 78, 79, 80
Brinkman, U., 48
Bruin, R. de, 105
Brown, C., 95, 105, 106, 111, 114
Brown, P., 45, 60, 61, 65, 68, 75, 80, 90
Burani, C., 133
Chen, H., 5, 7
Choi, S., 65, 78, 79, 80
Christiansen, J., 137
Coolen, R., 3, 4
Cutler, A., 4, 5, 12, 15, 18, 19, 21, 22
Danziger, E., 40, 60, 65, 68, 74, 77, 78
Deckers, A., 95, 106
Donselaar, W. van, 12
Dölling, J., 128
Drews, E., 96
Drexler, H., 19, 152
Drozd, K., 117, 120, 121
Flores d'Arcais, G., 7, 8, 98, 99
Frauenfelder, U., 18, 134
Gaskins, S., 65, 81
Groothusen, J., 95, 106
Gulikers, L., 152
Hagoort, P., 95, 105, 106, 108, 111, 114
Haveman, A., 10, 30
Haviland, J., 65, 81, 89
Heeschen, C., 37, 136, 137
Hendriks, H., 56, 121, 122
Hickmann, M., 121
Hill, D., 49, 50, 60, 65, 85
Hoëm, I., 88
Hout, A. van, 39, 41, 44, 45
Indefrey, P., 105, 106, 141
Inoue, K., 65, 68, 76
Jordens, P., 140
Keurs, M. ter, 112
Kita, S., 65, 90
Klein, W., 55, 56, 117
Koster, M., 11
Kuijk, D. van, 24
Kuijpers, C., 4, 12
de León, L., 65, 79, 81
Levelt, W., 3, 30, 34, 36, 65, 75, 76, 108, 126
Levinson, S., 65, 70, 74, 75, 90

Levy, P., 49, 50, 60, 65
Löbach, B., 121
Lucy, J., 65, 81

McQueen, J., 15, 16, 19, 21, 22
Messing, E., 68
Meijer, P., 31, 32
Meyer, A., 5, 28, 33, 34, 35, 36, 37

Neumann, S., 65, 84
Norris, D., 15, 21, 22
Nüse, R., 65, 82

Ouhalla, J., 131

Pederson, E., 60, 65, 68, 70, 73, 74
Piepenbrock, R., 152
Potter, M., 31
Powers, S., 140

Ramat, A., 123
Randall, J., 41, 44
Remmerswaal, K., 95, 106
Roach, P., 19
Roßdeutscher, A., 130
Roelofs, A., 27, 28, 29, 30
Roeper, T., 119
Roland, F., 121
Ruiter, J.P. de, 89, 91

Saito, H., 7, 8
Schmitt, B., 35
Senft, G., 62, 65, 68
Slobin, D., 80
Sorace, A., 43, 44
Sproat, R., 20, 21
Stoll, S., 58, 59
Stolz, C., 60, 65, 68
Strigin, A., 127
Swaab, T., 111

Turennout, M. van, 108

Valin Jr, R. van, 47, 137
Veer, C. van der, 152
Vonk, W., 44, 94, 100, 102, 108, 141

Wassenaar, M., 114
Weissenborn, J., 39, 41, 44, 117, 138, 140, 146
Weijer, J. van de, 5
Wheeldon, L., 34
Widlok, T., 65, 68, 86, 87
Wilder, C., 129
Wilkins, D., 47, 60, 65, 67, 68, 70, 74, 91, 137, 142
Wittenburg, P., 22, 24

Zimmerman, I., 130
Zwitserlood, P., 96