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Preface

Psycholinguistics is an inherently interdisciplinary field. Institutions which admit interdisciplinarity in their organization are, however, hard to find. For psycholinguistics this means that most of its practitioners work in a less interdisciplinary environment than they might consider optimal. Universities hardly have departments or faculties of psycholinguistics; most psycholinguists work either in a department of psychology or a department of linguistics. A whole institute of psycholinguistics, with dozens of full-time researchers and dozens of graduate students, exists only in Nijmegen. In the MPI for Psycholinguistics, the Max Planck Society created an institution which is unique, and which plays a very important role in its field, offering nourishment to the discipline of psycholinguistics worldwide - as our many graduates, ex-members of staff and visitors over the past decades can attest.

The institute's 2002 Annual Report describes a very successful year of research. As usual, the report is organized in terms of the project structure of the institute's research. By structuring the research in this way, we exploit the interdisciplinarity which our unique makeup incorporates - i.e., all projects involve both psychologists and linguists and the research is always informed by input from both psychological and linguistic theory.

This year two long-standing projects are listed for the last time. The Neurocognition of Language Processing project, supported for 10 years by NWO, came to its planned end in December 2002. A new NWO-supported project on Multilingualism began in January 2003. The Gesture project is also listed for the last time, although gesture research in the institute will continue in the Multimodal Interaction project, here listed for the first time.

The Neurocognition of Language Processing project has of course left an outstanding legacy in that it fed in many ways into the F.C. Donders Centre for Cognitive Neuroimaging, now in full operation on the University of Nijmegen campus nextdoor to our institute. A highlight of 2002 was the formal opening of the F.C. Donders Centre by Queen Beatrix of the Netherlands, in October. This occasion was preceded by a series of scientific and artistic events, officially launching the Centre's research life.

In 2002, founding director Willem Levelt took up the presidency of the Royal Netherlands Academy of Arts and Sciences (KNAW), a post which he holds jointly with his directorship in the institute. Further honours are listed in chapter 14 of this report. A late report from 2001 is that in December of that year our previous administrative director, Rolf Koenig, received from the hand of the German ambassador to the Netherlands the Bundesverdienstkreuz of the Bundesrepublik Deutschland for his services to the bilateral relations between Germany and the Netherlands.

To return to the theme of interdisciplinarity: during 2003, the institute is hosting a series of workshops on the fundamental relationships underlying psycholinguistics. More on this series (The Four Corners Workshops), as well as more research information, extensive technical information and corpus material, individual researcher's pages, and preprints of upcoming papers, can be found on our website (www.mpi.nl).

Anne Cutler

Nijmegen, April 2003

Organization of the Institute in 2002

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PROJECT DESCRIPTIONS

1 PHONOLOGICAL LEARNING FOR SPEECH PERCEPTION

The goal of the Phonological Learning for Speech Perception (PLSP) Project is to understand how phonological regularities in speech are learned and to determine the consequences of this learning for the comprehension of language. Since 2001 when the project was begun, it has included most of the work conducted on the NWO-supported Spinoza award to Anne Cutler. The project includes experimental work with infants and young children (section 1.1), studies of the computation of auditory categories in adults (1.2), and research assessing the role of native-language phonology in adults' speech comprehension (1.3).

1.1 Phonological categories in infants' speech processing and word learning

Swingley oversaw the move of the Baby Research Center (BRC) from its quarters in the U. Nijmegen's Spinoza Building to a suite in a new building, Montessorilaan 10, also on the university campus. The new location provides the BRC with considerably more space, including an additional room to be used for testing language development in 2- to 4-year-olds.

Infants know a great deal about the sounds of the language they hear around them before they start learning what words mean. To help understand how this knowledge is used when infants begin to learn words, Dietrich continued a series of studies exploring Dutch- and English-learning infants' judgments of the similarity of word forms, using the Conditioned Headturn method. Infants of 7–12 months were trained to respond to word forms containing the vowel /a/, such as *tak*. Then infants were tested for responses to the trained word and variants of it in

sentences. In place of /a/, variants included a vowel of a different *length* (e.g., tak), or a vowel of a different *quality* (e.g., tɛk). Because both vowel length and vowel quality can signal phonological differences in Dutch, infants were expected to consider the variants to be poor examples of the trained word, and therefore to respond infrequently. As predicted, infants did not conflate the trained word with either variant.

In collaboration with Werker (U. British Columbia), a parallel experiment was run to test how English-learning infants would evaluate changes in vowel length (which in English is not a contrastive feature in the way it is in Dutch). Infants were trained to respond to a word containing /æ/ and tested on a length variant (/æ:/) and a quality variant (/ɛ/). Contrary to predictions, Canadian infants' generalization pattern matched the Dutch pattern: infants did *not* consider word forms containing /æ/ and /æ:/ as equivalent. The results suggest that vowel length is used by infants in categorizing words, even for long/short vowel pairs that do not contrast in the language. The implications of this are being tested in a word learning study, also in collaboration with Werker.

Together with Shi (U. du Québec à Montréal) and Werker, Cutler examined the development of function-word recognition in infants. Previous research by Shi and Werker had shown that 6-month-old infants attend more to lexical words (which enjoy an acoustic advantage) than to function words. However, other research with older infants suggested that the presence of function words facilitates both speech production and comprehension. Thus it was important to map the progress from the earlier to the later stage. In this study monolingual English-acquiring infants heard sequences containing a monosyllabic lexical word preceded by either a real functor (e.g., *the*, *his*, *their*) or a nonsense functor (e.g., *kuh*). Nonsense functors were segmentally different from real functors, but prosodically alike. The infants' listening time to the two types of sequence was compared. Eight-month-olds' listening times for "real functor + lexical word" versus "nonsense functor + lexical word" sequences were not significantly different, suggesting that they did not recognize real functors, or that their functor representations lacked phonetic specification. Thirteen-month-olds, however, showed robust evidence of functor recognition, i.e., significantly longer listening time to sequences containing real functors than to sequences with nonsense functors. Therefore, somewhere between 8 and 13 months of age, English-learning infants

learn to recognize familiar functors and represent them with detailed segmental specifications.

Swingley completed two experiments evaluating the nature of young children's knowledge of the phonology of newly learned words. This work was motivated by research suggesting that well-known, familiar words like "ball" are encoded with full phonological detail by children as young as 14 months (Swingley and Aslin, 2002), while words taught in the laboratory may be stored only in a vague form by children. In the present experiments, children were first shown a movie in which a nonce word was used several times in semantically unconstraining contexts. Then children were taught a word for a novel object: the object was shown while recorded sentences like "That is a [novel word]" were played. For some children, the taught word was the word that had been familiarized in the movie; for others, the taught word was entirely new. After this teaching phase, children's recognition of the words was tested using a picture fixation procedure (see Annual Report 2000). Recognition was tested using correct pronunciations and mispronunciations of the taught words. Only the children who had received additional exposure to the taught words in the introductory movie revealed sensitivity to subtle mispronunciations. This suggests that hearing a word several times in a story enables children to form a phonological representation of that word, which then becomes the basis for word recognition when the child learns what the word means.

Another experiment examined 24-month-olds' sensitivity to changes in the vowel with which a word is uttered. In this experiment, children first watched an animated story narrated by a voice that either spoke normal Dutch, or spoke an accented form of Dutch in which some vowels were replaced with other Dutch vowels. After this exposure, children were tested for recognition of additional words using a visual fixation procedure. These additional words were pronounced either correctly, or using mispronunciations consistent with the accented forms. Results showed very large effects of the mispronunciations, without any effect of familiarization. Thus, children found vowel-altered words difficult or impossible to recognize even when the alterations were consistent with prior exposure to an accent.

Swingley continued computational work assessing the lexical knowledge infants may gain through the interaction of perceptual grouping mechanisms and the statistical characteristics of the speech sequences

infants hear (see Annual Reports 2000, 2001). Previous results had shown that in speech to infants, sequences having high frequency and *mutual information* (an information-theoretic measure of association, related to transitional probability) were usually words. New research tested whether this remained true when the input corpora were rendered more realistic by relaxing the assumption that infants accurately identify syllable boundaries. Variants of the test corpora were created using probabilistic syllable parsers that assigned consonants to syllables according to various non-language-specific criteria. Analyses of these corpora demonstrated that statistically associated syllables did tend to be words, though this tendency was much less marked in the new corpora than in the more idealized corpora. Despite the higher error rate, however, associated syllables tended to conform to the prototypical strong-weak stress pattern that infants are known to use in word finding. The results suggest that infants' exposure to speech helps build a phonological foundation for the early lexicon and could contribute to the development of probabilistic lexical parsing strategies.

1.2 Learning of auditory categories in adulthood

1.2.1 Unsupervised category formation

Goudbeek continued research on adults' learning of nonspeech auditory categories. Adult subjects were asked to listen to stimuli drawn from two probability distributions. In some experiments, stimuli varied in only one dimension (spectral peak); in others, stimuli varied in two dimensions (spectral peak and rate of pitch movement). In the unidimensional case, participants learned the categories successfully even when they had to perform a difficult secondary task (speeded-up visual lexical decision) during the learning phase, though the secondary task did hamper performance somewhat (see Annual Report 2001). New studies examining multidimensional category learning began with a series of experiments establishing the just-noticeable difference (JND) for the rate of pitch movement. This permitted generation of a set of stimuli in which pitch movement and spectral peak both varied over a similar range, as defined in JND units (which previously had been experimentally established for spectral peak). Listeners heard exemplars of categories defined in terms of one of the two dimensions, with the other dimension varying irrespective of category. Results showed that even when distributional information favored the formation of categories based exclusively on spectral peak,

listeners assigned category membership primarily on the basis of pitch movement. This outcome suggests a limitation in the generality of adults' ability to form auditory categories based on distributional information.

1.2.2 Lexical knowledge and category learning

Previous research by McQueen and Cutler, in collaboration with Norris (MRC Cognition and Brain Sciences Unit, Cambridge), has shown that adults' phonetic categories can be modified through exposure to speech sounds that deviate from the prototypical representations of those categories (see Annual Report 2001). When listeners had been exposed to an ambiguous sound that lay midway between [f] and [s] in lexical contexts, a subsequent shift in phonetic categorization responses to sounds from an [f]–[s] continuum was observed. The direction of the shift depended on the lexical context in which the ambiguous sound was presented in the exposure phase: When it appeared in [s]-final words, listeners gave more [s] responses in the categorization task; when it appeared in [f]-final words, listeners gave more [f] responses. When the ambiguous sound was presented in contexts that would be nonwords with either an [f] or [s], no shift took place. These findings can be explained in terms of a perceptual learning mechanism that is at work when listeners encounter a speaker of an unfamiliar dialect: Retuning of the listeners' phonetic categories could benefit their future comprehension of that talker's speech.

In these earlier experiments, exposure consisted of a lexical decision task: Listeners had to decide whether sequences ending with the ambiguous sound (and filler words and nonwords) were real Dutch words. New research has shown that the same perceptual adjustment occurs even with passive exposure. Listeners heard the same stimuli, but simply had to count the number of stimuli that they heard. The effect on subsequent categorization of the [f]–[s] continuum was statistically indistinguishable from that observed earlier, suggesting that the effect does not depend on the need to make explicit judgments about the critical stimuli during the exposure phase. Another study, together with Butterfield (MRC Cognition and Brain Sciences Unit, Cambridge), examined whether the same kind of perceptual learning could also be found in the visual modality. English subjects made lexical decisions to letter strings, some of which ended with an ambiguous letter, midway between H and N, in either H-final or N-final words. After exposure, the subjects categorized the letters on an H–N continuum. In spite of the close similarity with the previous speech

experiment, no lexically modulated perceptual learning was observed. This result suggests that the effect observed earlier is special to the spoken modality, and that this kind of perceptual learning is an integral part of the speech perception system.

The first experiments in Eisner's Ph.D. project examined whether the learned retuning of a phonetic category would generalize to a new speaker. Subjects made lexical decisions to words containing an ambiguous sound, and then categorized ambiguous fricatives presented in the context of a vowel uttered by a different speaker. In one condition the new speaker was female, like the speaker in the exposure phase; in a second condition the new speaker was male. Listeners in both conditions were found to display a shift in categorizing the continuum, similar to subjects who had listened to the same speaker at exposure and test. These results show that adaptation that takes place in the speech perception system in response to one speaker affects processing of the speech of another speaker encountered immediately afterwards.

1.3 Native phonology in adult listening

1.3.1 Rhythmic classes

As described in previous annual reports, an ongoing interest of the research group involved in this project concerns language-specific processing in listening to spoken language. For instance, listeners typically exploit native-language rhythmic patterns to segment speech; procedures based on stress, syllable patterning and mora structure have been identified in prior research. These language-specific procedures then play a role in the difficulty of listening to non-native languages; non-native listeners do not show the response patterns that native listeners show in segmentation experiments in a given language, but their responses instead tend to pattern as in their native language.

In 2001, Murty and Cutler began a series of experiments on listening to Telugu, a Dravidian language sharing certain phonological properties (but no historical relationship) with Japanese (see Annual Report 2001). Explicit comparisons with Japanese, for which prior research had shown evidence of moraic segmentation by native listeners, were included in the project. In experiments requiring detection of target sequences in speech, Japanese listeners experience difficulty with targets whose boundaries do not correspond to mora boundaries. Previous experiments in which

Japanese has been presented to non-native listeners with differing language backgrounds have failed ever to replicate this mora-sensitive pattern. However, Telugu listeners, presented with spoken Japanese, did respond faster and more accurately to targets that matched a mora than to those that did not. Japanese speakers, in a similar experiment with Telugu materials, displayed a moraic segmentation strategy as with their own language and other languages. The Telugu speakers were the first non-native group to replicate the kind of mora sensitivity that Japanese speakers exhibited in all the previous experiments they participated in.

In 2002, Murty, Cutler and Otake (Dokkyo U.) continued the series of experiments with a new set of Telugu materials and conducted two sets of experiments, one each with the Telugu and Japanese native speakers respectively in India and Japan. The results of these experiments again showed that Telugu listeners responded more accurately to targets that matched an exact mora than to those that did not match a mora, replicating a pattern that was found in the 2001 experiment. The responses of the Japanese speakers confirmed once again that Japanese listeners are sensitive to the mora irrespective of the language they are processing. In another set of experiments, Murty, Cutler and Otake conducted a phoneme-monitoring experiment with Telugu speakers, using Japanese and English stimuli. Besides providing information on whether Telugu listeners find it easier to identify vowels or consonants in a non-native language, these experiments provided an opportunity to examine whether there are differences in the way listeners process phonemes in a non-native language they are familiar with (in this case, English) and one they have never heard before (Japanese). The results of the phoneme-monitoring experiment in English show that Telugu speakers find it easier to identify English vowels than consonants, a pattern that differs from that observed in predecessor studies with English listeners. However, most strikingly, the Telugu listeners also detected moraic phonemes more rapidly than nonmoraic phonemes. This too was a difference not shown by English listeners; but here again the results of the Telugu listeners patterned similarly to those of Japanese listeners with the same English materials. Together these results strengthen the view of rhythmic classes across languages, whereby certain aspects of gross phonological structure play a role in listeners' segmentation of continuous speech.

1.3.2 Native phonology in non-native word recognition

Another continuing interest in the present project concerns the effects on comprehension of phonemic repertoire mismatch between a first and a second language. When the phoneme categories of a non-native language do not correspond to those of the native language, the non-native categories may be inaccurately perceived, and this in turn can affect spoken-word recognition in the non-native language. A new dissertation project (Wagner) is beginning in this area, in which the main focus concerns the consequences of the size and structure of the phoneme repertoire on phoneme identification in native and non-native listening. A first phoneme detection study compared native listeners of Dutch and German, languages with approximately as many vowels as consonants, and listeners of Spanish, a language with only five distinct vowels. The listeners detected vowels and consonants in 3- or 4-syllable nonwords recorded by a Dutch speaker. The segments to be detected were surrounded by context that had been manipulated such that acoustic information cuing a following phone either was or was not misleading. German and Dutch listeners reacted equally rapidly to vowels and to consonants, whereas Spanish listeners detected vowels faster than consonants. These results are consistent with the hypothesis that a smaller population of vowels in a language facilitates detection of vowels. The context manipulation, however, only affected the reaction times to plosives, and the small effect of this manipulation did not differ across languages.

Broersma investigated the causes underlying Dutch listeners' inaccurate processing of the voicing distinction in English fricatives. Although Dutch has voiced and voiceless obstruents, only voiceless obstruents can occur in syllable-final position. Previous experiments (Annual Report 2001) showed that the inaccurate processing of the voicing distinction in English by Dutch listeners led to the activation of spurious lexical competitors. A categorization experiment was used to investigate whether Dutch listeners, who are obviously able to distinguish voiced and voiceless obstruents in syllable-initial and intervocalic position, are able to do so in word-final position as well. Their use of the length of the preceding vowel as a cue for voicing was examined. In one part of the experiment, Dutch and English participants heard [v] and [f] sounds occurring at the beginning of a single nonword; in the other part of the experiment they heard these sounds at the end of a nonword. Participants indicated by button press whether they had heard [v] or [f]. Because the nonword

context was kept constant within each block, vowel length could not be used as a cue to voicing in final position. The nonword was originally pronounced with a final [v], and vowel length therefore mismatched final [f]. The results show that this mismatch hampered the English participants' performance for [f] in final position. In fact, their performance on final [f] cases was worse than that of the Dutch participants. The Dutch performed equally well on [v] and [f] in either position, suggesting that they did not use vowel length as a cue. Although the Dutch showed that they were able to distinguish word-final [v] and [f] in this categorization experiment, the fact that they did not use the important cue of preceding vowel length may explain why they do not manage to make the voicing distinction correctly under other circumstances, when the cues other than vowel length may be more difficult to detect.

Finally, Weber and Cutler continued their studies of the effect of phonetic discrimination difficulties on competitor activation in non-native listening via eye-tracking measures (see Annual Report 2001). The previous results had shown that Dutch listeners who were asked to click on pictures of objects on a computer screen would fixate distractor pictures with confusable English vowels (e.g., a pencil, given the instruction to click on a panda) longer than distractor pictures with distinct vowels (a pirate, given the instruction to click on a parrot). In a follow-up experiment it was observed that the confusion was not symmetric: distractors with /ɛ/ (pencil) were confused with targets with /æ/ (panda), but the reverse was not the case. A further follow-up experiment established that native English-speaking listeners did not confuse any of the target-distractor pairs. The new results shed more light on non-native listeners' phonetic processing and the scope for activation of spurious lexical competitors that should not be activated for native listeners.

2 DECODING CONTINUOUS SPEECH

Researchers in the Decoding Continuous Speech Project have continued to investigate the mental processes and representations underlying spoken language comprehension (see Annual Report 2001). As in last year's Annual Report, the project's research will be presented under four main headings: "Prelexical decoding", "From sounds to words", "Lexical decoding", and "From words to meanings". There are, however, a number of unifying themes running through the project. One is the acknowledgment of the central role of the mental lexicon in speech decoding. This perspective is taken because words provide the only means by which listeners can map the physical speech signal onto representations of the meaning of utterances. The processes that precede and follow lexical access are therefore examined from the perspective of their relationship to spoken-word recognition. Another theme has been the repeated demonstrations in the project that recognition processes are sensitive to extremely subtle differences in the speech signal (see also Annual Reports 2000, 2001). This sensitivity has important implications for models of speech decoding. A third theme concerns the way in which information flows through the speech-recognition system: A number of different findings suggest that information flows continuously through the system, in cascade from lower to higher levels.

The project expanded in 2002 with three new members. Ernestus took up a part-time staff position. Her research is described below. Shatzman and Kuzla began their Ph.D. projects. Kuzla will be examining prosodically conditioned realization of phonetic detail in German, and its role in speech decoding. Shatzman will be using eye tracking to examine how Dutch listeners use fine detail in the spoken signal to segment continuous speech.

2.1 Prelexical decoding

2.1.1 Diphone database

Previous Annual Reports (1999, 2000, 2001) described how Smits, Warner (U. of Arizona), McQueen and Cutler conducted and analyzed a large gating experiment involving all 1,179 diphones of Dutch, gated at six points during each diphone. The goal of this project (in collaboration with Norris, MRC Cognition and Brain Sciences Unit, Cambridge) has been to develop and test a new version of the Shortlist model of spoken-word recognition (see Annual Reports 1994–2001), in which word activation is sensitive to time-varying probabilistic information about the speech sounds in the input signal. In collaboration with Bayerl (U. Giessen), a database of the diphone project has been put on the MPI web site (<http://www.mpi.nl/world/dcsp/diphones>). This database, which includes all stimuli and listeners' responses, can be freely downloaded.

2.1.2 Assigning cues to segments

Smits continued his joint research project with Nearey (U. of Alberta) studying how listeners phonemically parse speech, that is, how listeners determine the number of phonemes in an utterance as well as the identities of those phonemes. Successful parsing of the cues in the speech signal is essential for successful lexical access. Smits and Nearey conducted a simplified version of an earlier experiment (see Annual Report 2001). The new experiment involved voiced stops rather than stop-nasal sequences. Synthetic /aC(C)a/ stimuli were created, which consisted of a voiced part with closure transitions followed by silence and a voiced part with opening transitions. The closure and opening transitions and the silence duration were varied orthogonally. The resulting stimuli were presented to Canadian English-speaking subjects for categorization, with the following response alternatives (the last two being geminates): /b, d, bd, db, bb, dd/. Logistic regression analysis showed that perceived singletons, heterorganic clusters and geminates all have distinct durations. Results for identification of place of articulation were remarkably simple. The weight of the closure transition cue for perceived place of the "closure consonant" was independent of the number of perceived consonants or their places. The analogous pattern held for the opening transitions and the "opening consonant", with the exception of singleton /b/. These findings support a simple model of phoneme parsing and cue allocation in VC(C)V sequences: Formant transition cues at closure and release signal

consonant place of articulation and do not interact either with one another or with durational cues, which, instead, signal the number of phonemes.

2.2 From sounds to words

2.2.1 The voicing distinction in word-initial position in Dutch

Van Alphen continued her project on the production and perception of prevoicing variation. A production study on the voicing distinction in Dutch initial plosives (see Annual Report 2001) showed that 25% of the voiced tokens in the sample were produced without prevoicing. Several factors affecting vocal tract volume (e.g., speaker sex) influenced the proportion of prevoiced tokens, suggesting that prevoicing was absent due to aerodynamic limitations. Detailed acoustical analyses identified several acoustic correlates of voicing, of which prevoicing appeared to be, by far, the best predictor. Perceptual classification of these tokens showed that prevoicing was indeed the strongest cue to the voicing distinction, even though prevoicing was frequently absent in voiced plosives. Some of these tokens were still classified as voiced on the basis of secondary cues. These secondary cues were different for the two places of articulation (for labials, the F_0 movement into the vowel; for alveolars, the spectral center of gravity of the burst).

Van Alphen also continued to investigate the influence of prevoicing variation on lexical access. She completed her series of priming experiments (see Annual Reports 1999, 2000) with one more identity priming experiment and a discrimination experiment in which the lexical status of both the voiced and voiceless items was systematically varied (see Annual Report 2000 for more details). The results indicated that quantitative prevoicing variation in the primes (12 vs. 6 periods of prevoicing on their initial voiced plosive) did not affect the degree of activation of lexical candidates with voiced plosives. Qualitative variation in prevoicing, however, did have an effect: Primes without prevoicing activated both voiced and voiceless lexical candidates, while items with prevoicing only activated voiced candidates. Thus, in the case of items with two competing candidates (e.g., *beer* 'bear' - *peer* 'pear'), activation of the voiceless word was detectable when there was no prevoicing in the primes, but not when the primes had prevoicing, while activation of the voiced word was detectable both when the primes had prevoicing and when they did not. The presence versus absence of prevoicing in Dutch voiced plosives therefore appears to affect lexical access. These results

suggest that information about acoustic fine detail is passed continuously up to the lexical level of processing.

2.2.2 Incomplete neutralization of word-final voiced obstruents

While voiced obstruents in Dutch (including the plosives studied by van Alphen) can occur in word-initial position, those in final position are devoiced. Previous research at the Institute, however, has suggested that final devoicing is phonetically incomplete in Dutch, with underlyingly voiced obstruents being realized as slightly voiced (see Annual Report 2000). This earlier research also suggested that listeners are sensitive to incomplete neutralization, since they can distinguish, at better than chance levels, the phonetic realizations of words which underlyingly end in voiced obstruents from those ending in voiceless obstruents. Ernestus, in collaboration with Baayen (U. Nijmegen), examined the relative roles of incomplete neutralization and lexical analogy in listeners' voicing judgments.

Lists of Dutch pseudowords were read aloud by a speaker. The final obstruents were found to be shorter and consequently sounded more voiced when they had been orthographically represented as voiced than when they had been represented as voiceless. This shows that incomplete neutralization can be induced in Dutch just by the way words are spelled, and that minimal word pairs are not required for incomplete neutralization to emerge. The pseudowords were presented to listeners whose interpretation of the final obstruents as underlyingly voiced or voiceless was judged through a past-tense generation task (e.g., the simple past of [bɛx] could be written as *begde*, with a voiced obstruent, or as *bechte*, with an unvoiced obstruent). Previous work by Ernestus and Baayen has shown that when the neutralization of final obstruents is complete, listeners base their voicing judgments on phonologically similar words, since words ending in the same type of rhyme tend to end in an obstruent with the same [voice] specification. That is, they tend to interpret neutralized final obstruents of pseudowords in conformity with the majority of existing words ending in the same rhyme.

In the present study, listeners again based their interpretation of the final obstruents on phonologically similar words, but they also based them on the incomplete neutralization. They interpreted slightly voiced obstruents as underlyingly voiced more often than completely voiceless obstruents. This confirms that Dutch listeners are sensitive to the subtle cues to

incomplete neutralization that exist in the speech signal. These experiments involved three lists of pseudowords, which differed in the percentage of words with slightly voiced final obstruents. These percentages appeared to affect both the speaker's realizations and the listener's interpretations. When the list contained many final obstruents that were orthographically represented as voiced, the speaker also produced final obstruents that had a neutral spelling as voiced. This speaker-related transfer effect probably results from automation of the articulatory gestures, which produce in slightly voiced or completely voiceless obstruents. Listeners interpreted slightly voiced obstruents as underlyingly voiced more often when there were fewer other slightly voiced obstruents in the list. This suggests that the baseline against which voicing is evaluated has a higher voicing threshold when there are more slightly voiced final obstruents in the list. This perceptual transfer effect probably reflects the way in which listeners dynamically adapt to their conversation partner's speech habits or dialect (see related findings in section 1.2.2 Lexical knowledge and category learning).

2.2.3 Distinctive features in word recognition

In collaboration with Mak (U. Nijmegen), Ernestus investigated whether listeners rely more on some phonological distinctive features than on others in word recognition. She compared voice with manner and place of articulation in Dutch, a language in which voice is relatively uninformative as it is often not realized in accordance with the lexical representation of the word (e.g., in word-final devoicing). In word-initial position, voice is uninformative only for fricatives. In a lexical decision experiment, different listeners heard different versions of fricative- and plosive-initial words. The initial consonant was realized in accordance with the lexical representation of the word (e.g., *samba* 'samba' and *veld* 'field', or *duif* 'pigeon' and *takel* 'tackle'), or with incorrect voice (*zamba*, *feld*, *tuif*, *dakel*), incorrect manner (*tamba*, *zuiif*), or incorrect place (*zeld*, *pakel*). Listeners tended to accept fricative-initial words that were realized with incorrect voice as existing words of Dutch. All other versions that deviated from lexical representations were classified as nonwords. When listeners correctly classified nonlexical representations as nonwords, they took longer when a fricative was realized with incorrect voice than in the other conditions. These results show that features are less relevant for auditory word recognition if they are less informative for a given type of segment in a given position in the word.

2.3 Lexical decoding

2.3.1 Prosodically conditioned phonetic strengthening

Cho conducted an acoustic study on the interface between prosody and phonetics, investigating how low-level phonetic realizations are conditioned by prosodic structure in Dutch. In particular, Cho has examined the effects of prosodic boundaries, lexical stress and phrasal accent on the acoustic realization of stops (/t, d/) and fricatives (/s, z/), in order to evaluate how phonological features associated with consonants are phonetically realized in prosodically strong locations (e.g., in lexically stressed syllables, in accented syllables, and at edges of prosodic domains). The acoustic realization of consonants varied systematically with the prosodic positions in which they occurred. For example, stop closure duration showed strengthening in that it was longer for both /t/ and /d/ in all prosodically strong locations. This can be interpreted as an enhancement of consonantality ([+consonantal]). Voice Onset Times (VOTs) for voiceless stops, however, were shorter in prosodically strong locations, unlike in English, where the opposite pattern is observed (i.e., longer VOTs in prosodically strong locations). These opposite VOT patterns can nevertheless still be interpreted in terms of prosodically conditioned articulatory strengthening. The longer VOTs in English are likely to be due to strengthening of the glottal abduction (opening) gesture, whereas the shorter VOTs in Dutch can be ascribed to strengthening of the glottal adduction (closing) gesture (note that, in general, English voiceless stops have longer VOTs than Dutch voiceless stops). The opposite VOT results can further be explained in terms of crosslinguistic differences in featural enhancement: Elongated VOTs in English enhance the feature [+spread glottis], while shorter VOTs in Dutch enhance [-spread glottis]. Overall, although phonetic phenomena such as intonation and domain-final lengthening are known as primary correlates of prosodic structure, these results suggest that prosodic structure is also signaled by prosodically-driven consonantal strengthening in prosodically strong locations, and that these strengthening patterns are conditioned by language-specific phonological feature systems.

Cho and McQueen have started to investigate listeners' use of prosodically conditioned phonetic detail in the segmentation of continuous speech into words. They tested whether the acoustic manifestation of domain-initial strengthening of consonants influences segmentation in American English, using two crossmodal identity priming experiments.

This research was based on previous studies that had shown that, in American English, consonants that are initial in a larger prosodic domain (e.g., an Intonational Phrase, IP) are produced more strongly than domain-medial consonants, as reflected in larger linguopalatal contact, longer stop seal duration, and longer VOT. Together with the new acoustic analyses on phonetic strengthening in Dutch, these results suggest that low-level phonetic realization is inextricably entwined with prosodic structure.

It was hypothesized that in a two-word sequence, if domain-initial strengthening of the second (postboundary) word assists listeners in word segmentation, the recognition of the first (preboundary) word would be facilitated. In one experiment, listeners heard identity- and cross-spliced versions of sentences such as (1) and saw either a related word (the preboundary word, e.g., *bus*) or an unrelated word, which was presented at the onset of the postboundary word (*tickets*). In the identity-spliced version of the sentence, the initial Consonant-Vowel (CV) sequence of the postboundary word was spliced from another token of that sentence. In the cross-spliced version, the CV was spliced from a matched sentence with an IP boundary (2) and thus contained a strengthened consonant.

(1) John forgot to buy bus # tickets for his family.

(# = Word boundary)

(2) When you get on the bus, # tickets should be shown to the driver.

(# = IP boundary)

Visual lexical decisions were faster on related than on unrelated trials in the cross-spliced sentences but not in the identity-spliced sentences. This suggests that the strengthening of the initial portion of the second word assisted word recognition. The second experiment was identical, except that listeners heard identity- and cross-spliced versions of sentences with IP boundaries, such as (2). The cross-spliced CVs came from the matched sentences used in the first experiment, such as (1). There was a significant related-unrelated difference for both types of sentence. It thus appears that when other boundary cues are available (e.g., preboundary lengthening and boundary tones), domain-initial strengthening plays a lesser role in segmentation, especially when considering the recognition of words in preboundary position. The results of these two experiments nevertheless suggest that fine-grained information associated with domain-initial strengthening can influence lexical segmentation. More

generally, they offer further support for the view that lexical decoding is modulated by subtle phonetic detail in the speech signal.

2.3.2 The Possible Word Constraint (PWC)

Lexical segmentation has also been investigated from a crosslinguistic perspective in a continuation of research on the PWC (see Annual Reports 1995-2001). According to the PWC account, segmentation is the consequence of competition between candidate words, and this competition process is modulated by a mechanism that disfavors some of those candidate words. Previous crosslinguistic research has suggested that there is a simple language-universal constraint that determines whether a candidate should be disfavored (see Annual Report 2001). Candidates appear to be disfavored when the stretch of speech between a likely word boundary and the edge of the candidate does not contain a vowel. Such vowelless residues in the lexical parse of an utterance are not possible words.

Languages with vowelless syllables provide an important test of the PWC. McQueen, Cutler, and Otake (Dokkyo U.) examined the case of devoiced vowels in Japanese. The high vowels /i/ and /u/ can be devoiced utterance-finally after a voiceless obstruent, or when they occur between two voiceless obstruents (e.g., *matsu kara* 'from a pine tree', spoken as [matskara]). In this example, the vowelless sequence [ts] stands for the underlying syllable /tsu/; do such sequences therefore count as possible words? Following earlier research on this issue (see Annual Report 1998), a more tightly controlled word-spotting experiment was carried out. Japanese listeners found it harder to spot words beginning with voiceless obstruents such as *hamu* 'ham' in nonsense contexts ending with a voiceless obstruent (e.g., *nyakhamu* where a devoiced vowel was possible after the [k]) than when the context ended with a vowel (e.g., *nyaguhamu*). In contrast, however, listeners found it almost impossible to spot vowel-initial target words in contexts ending with a voiceless obstruent (e.g., *ane* 'sister', in *shasane*, where there is no possible devoiced vowel after the [s]), and very much easier to spot the same words in vowel-final contexts (e.g., *shazuane*). These results suggest that Japanese listeners are able to treat single consonants as viable residues in their parse of the speech signal, but only when that consonant also represents an underlying vowel (e.g., the [k] in *nyakhamu*, which could stand for /ku/).

Cutler, McQueen and Carvalho have also examined this issue in a word-spotting experiment in Portuguese. Unstressed syllables in European Portuguese can be pronounced without a vowel (e.g., the first syllable of *descalabro* 'disaster' is pronounced as [dʃ]). It appears that these vowelless sequences, like those in Japanese, can count as possible words. Listeners from Portugal found it just as easy to spot words such as *calor* 'heat' in *descalor* (which begins with the vowelless syllable [dʃ]) as in *boscalor* (which begins with a syllable with a vowel [boʃ]). This effect, however, was modulated by the lexical competitor environment: There was no difference between these two context conditions when the vowelless sequence was the beginning of another word (e.g., *descalor* begins in the same way as *descalabro*), but word spotting was harder when the vowelless sequence was not a word onset (e.g., *belo* 'beautiful' in *desbelo* vs. *mosbelo*, where there are no words beginning [dʃb]). This suggests that vowelless sequences in European Portuguese are only viable residues in the parse of an utterance when they are supported by at least one lexical candidate. Together with the Japanese results, they suggest more generally that consonantal sequences can be treated by listeners as possible words in speech segmentation, but only when those sequences contain underlying vowels, as determined by the phonology of the listener's language.

Cutler, McQueen, Jansonius, and Bayerl (U. Giessen) tested the usefulness of the PWC using statistics on lexical embedding in the vocabularies of English and Dutch. Embedded words (e.g., *can* in *scan*) are likely to be activated when listeners hear carrier words (e.g., *scan*). The CELEX database was used to count the number of embedded words that would be penalized by the PWC (i.e., those where the carrier word consists of the embedding plus consonantal residue(s), e.g., *can* in *scan* or *cant* or *scant*) and those which would not (i.e., those where the residue(s) contain vowels, e.g., *can* in *pecan* or *canny* or *mechanic*). These counts were then multiplied by the frequency of occurrence of the carrier words. The analyses showed that the PWC would remove a clear majority of embedded words in both English and Dutch. The PWC can therefore contribute significantly to the efficiency of speech recognition.

2.4 From words to meanings

Dahan, in collaboration with Tanenhaus (U. of Rochester), conducted a study examining the activation of visually based conceptual represen-

tations during the recognition of spoken words. The eye movements of Dutch participants to four objects displayed on a computer screen were monitored as they heard the name of one of the objects. The participants' task was to click and move the mentioned object using a computer mouse. The display consisted of the picture of a referent (e.g., a snake), the picture of a visual distractor that shared visual features with the concept associated with the referent's name (e.g., a rope), and the pictures of two unrelated objects (e.g., a couch and an umbrella). Critically, the names of the distractors (e.g., *touw* 'rope', *bank* 'couch', and *paraplu* 'umbrella') did not overlap phonologically with the name of the referent (e.g., *slang* 'snake'). As the first sounds of the referent's name were heard, participants were more likely to fixate the visual distractor than either of the unrelated objects. This demonstrates that perceptually based conceptual/lexical representations become activated during the earliest moments of lexical processing, as would be expected in a model of speech processing in which information flows continuously and immediately from lower to higher levels. Because the name of the visual distractor did not overlap with the phonetic input, the results indicate that eye movements performed in such a task reflect word-object matching at the level of lexically activated perceptual features and not at the level of pre-named sound forms.

3 UTTERANCE ENCODING

The Utterance Encoding Project examines how speakers plan the production of speech in a conversational setting or otherwise. Work in this project continued to examine the encoding of single-word utterances (described in sections 3.1 and 3.2) and multiple-word utterances (section 3.3). The work on single-word utterances aimed to further develop and test the theory of lexical access that has been developed within the project (a recent overview of the theory can be found in the *Proceedings of the National Academy of Sciences USA* article by Levelt 2001). Work has also continued on the computational implementation of the theory, the WEAVER++ model.

According to the theory, word planning traverses from conceptual preparation via lemma retrieval to word-form encoding and syllabary access. New response time and electrophysiological experiments were conducted to test aspects of the theory.

3.1 From concept to phonological form

3.1.1 An electrophysiological study of semantic and phonological context effects

In the picture-word interference paradigm, pictures of common objects are named while participants try to ignore simultaneously presented distractor words. Compared with unrelated words, semantically related distractors typically increase object naming latencies while phonologically related distractors speed up naming. According to WEAVER++, the semantic interference effect in object naming is a net result of facilitation in conceptual preparation and interference in lemma retrieval, whereas phonological facilitation arises during word-form encoding. This was tested

by Abdel Rahman and Roelofs measuring Lateralized Readiness Potentials (LRPs).

Pictures of common objects were presented simultaneously with a pair of semantically or phonologically related distractor words or with two rows of Xs (the double distractor technique developed by Abdel Rahman and Melinger, see Annual Report 2001). Participants were instructed to perform a manual two-choice go/nogo task that involved semantic feature processing and phonological encoding. The choice of the responding hand was determined by an animacy classification (animal vs. object), whereas the go/nogo decision was based on a phonological form classification (initial segment /s/ vs. /k/). To identify the processing levels affected by the different distractor types, the LRP was time-locked to both the onset of the stimulus (S-LRP) and the execution of the response (R-LRP). Stimulus-locked and response-locked LRPs provide complementary information about the duration of semantic processing (the interval between stimulus onset and the beginning of central response, S-LRP) and about the timing of phonological encoding (the duration of processes between activation and execution of the response, R-LRP). Additional picture-naming trials were included to test whether the typical behavioral pattern of interference and facilitation was obtained with the used stimulus material.

Naming latencies were longer when a picture was accompanied by semantically related words than when it was accompanied by phonologically related words, suggesting that the pictures and distractors induce the classic picture-word interference effects. The stimulus-locked LRP onset latencies were faster when the distractors were semantically related than when they were phonologically related to the picture. This result indicates that one locus of semantic distractor effects is facilitation at the conceptual processing level. For the response-locked LRP, a reversed pattern of effects was obtained. Here, the LRP onset latencies were slower for the semantically related than for the phonologically related words, indicating additional interference at lexical processing stages. In a second condition, the assignment of the semantic and phonological classification to choice response and go/nogo decision was reversed. Here, the stimulus-locked LRP onset latency revealed the duration of phonological encoding whereas the response-locked LRP provided a measure of semantic processing duration. Again naming times showed the classic semantic interference and phonological facilitation effects. However, the S-LRP onset latencies were slower when the distractors

were semantically related than when they were phonologically related, whereas the corresponding R-LRP onset latencies were faster. These findings reveal supplementary evidence for combined distractor effects at conceptual-semantic and lexical processing levels.

Together, the LRP results show that the current paradigm can be used to directly relate the effects of different distractor types to distinct processes during object naming. Moreover, the results support WEAVER++'s claim that the semantic interference effect of distractors on object naming latencies is the net result of facilitation in conceptual processing and interference in lemma retrieval.

3.1.2 Picture-word interference with multiple distractors

Abdel Rahman and Melinger continued their chronometric investigation of speech production processes using the double distractor variant of the picture-word interference procedure that they developed in 2001. Having established that speakers process both distractor words and that the classic effects found with picture-word interference can be boosted with the double-distractor method, they conducted two series of studies on the interplay between different distractor types during object naming.

The first series investigated the relationship among semantic category, associate, and phonological distractor effects using the additive factors method. According to this method, under the assumption of discreteness of information transmission, two factors should interact if they affect the same processing stage while their effects should be additive if they affect different processing stages. Prior studies applying this method with single mixed distractors (e.g., CALF for the picture cat, which is both semantically and phonologically related) have provided evidence that semantic interference and phonological facilitation effects interact. Unfortunately, all prior studies investigating this issue used different distractor words in the mixed conditions than in the pure conditions; thus the expected effect size could not be precisely calculated nor could potential items effects be ruled out. Abdel Rahman and Melinger used their double distractor method to test for additivity because it allows a direct comparison between the individual effects of two words presented alone to the magnitude of the effect when the words are presented together. They found additive effects of categorically and phonologically related distractor pairs (e.g., HORSE and CAB for the target picture cat) and interactive effects of semantic categorically and associatively related distractor pairs (e.g., HORSE and

WHISKERS for the target picture cat). These results suggest that semantic category and associative effects are located at the same processing stage while phonological effects are located at a separate stage.

In a second series of experiments Abdel Rahman and Melinger investigated whether semantic competitors or associates of the picture name receive any activation at the word form level. So far evidence for phonological coactivation has only been obtained for extreme semantic relations (e.g., synonyms: *sofa* and *couch*) but not for simple semantic competitors (e.g., *sofa* and *chair*) or associates (e.g., *mouse* and *cheese*). In two experiments target pictures were presented with two distractor words that were phonologically related to either the target picture name, a semantic competitor, a semantic associate, or unrelated. Distractor word pairs that were phonologically related to either semantic competitors or associates delayed picture naming latencies as compared to unrelated words. These results can be interpreted in terms of either phonological coactivation of semantic competitors and associates or in terms of the direct activation of a phonological cohort at the lemma level.

3.1.3 Naming objects and faces

Research on the identification and naming of familiar faces has consistently shown a temporal advantage for retrieving semantic information such as biographical knowledge about nationality or occupation as compared to proper name retrieval. This observation has traditionally been interpreted as reflecting a serial ordering of access to semantic and name information. In contrast to this robust finding, Abdel Rahman, together with Sommer (Humboldt U. Berlin) and Olada (U. Krasnojarsk, Russia), observed faster name retrieval for children up to the age of 11 years. This naming advantage is difficult to explain with serial processing of semantic and name information because it would require the assumption of a reordering of processing stages during adolescence. The finding is in line with electrophysiological evidence on the timing of semantic and phonological encoding in object naming (see Annual Report 2001), favoring the view of parallel access to semantic facts and names of familiar faces.

Whether or not the empirical findings on distractor effects in object naming can be generalized to the naming of familiar faces is unclear. Moreover, little is known about the effects of distractor words that are hyperonyms of the target in object naming. Damian (Bristol U.) and Abdel Rahman

directly compared the effects of such distractors in the naming of common objects (e.g., target dog, distractor ANIMAL) and familiar faces (e.g., target Bruce Willis, distractor ACTOR). Both the naming of objects and faces was facilitated by the presentation of hyperonyms suggesting that face naming may be considered as a special instance of object naming.

3.1.4 Modeling the hemodynamic correlates of interference

Performing a picture-word interference task requires executive control to guarantee that the picture is named rather than the word orally read. The control of naming has been perhaps in its simplest form most intensively examined in chronometric and neuroimaging studies using the color-word Stroop task, in which the ink color of color words (e.g., the word RED in green ink) is named. Based on the existing evidence, Roelofs and Hagoort evaluated two prominent implemented models of control in naming and reading: GRAIN and WEAVER++. GRAIN implements the view that executive control is achieved by associatively biasing activation levels of responses. WEAVER++ implements the view that responses are controlled through explicit, symbolic reference to goals. Computer simulations revealed that WEAVER++ offers a more satisfactory account of the data than GRAIN. In particular, WEAVER++ successfully simulated the blood-flow response during Stroop task performance in one of the classic brain areas involved with executive control, namely, the anterior cingulate cortex.

3.1.5 Automatic versus voluntary activation of words by objects

The picture-word interference paradigm exploits the fact that distractor words activate their memory representations. Roelofs conducted a series of experiments to examine the extent to which distractor pictures activate their memory representations, including their names. Semantic facilitation was obtained from distractor pictures in word categorization requiring conceptual access from written words. For example, saying "animal" to the word HOND (dog) was speeded up by a pictured cat (semantically related) compared with a pictured train (unrelated). Also, semantic facilitation was obtained from distractor pictures in word reading with a determiner requiring syntactic access from words (saying "de hond" to the word HOND in a pictured cat vs. train). Semantic facilitation was not obtained from irrelevant pictures in word-plus-determiner reading requiring no syntactic access (saying "de hond" to DE HOND in a pictured cat vs. train) and also not in bare word reading (saying "hond" to the word HOND in a pictured cat vs. train). In contrast, the standard semantic interference effect was

obtained from distractor words in picture naming (saying "hond" to a pictured dog with the words KAT vs. TREIN superimposed) and distractor words yielded interference and no semantic effect in word reading (saying "hond" to the word HOND while ignoring the words KAT vs. TREIN). These results suggest that conceptual and syntactic access of words by objects is outside voluntary control, refuting claims to the contrary by Altmann and Davidson (2001) and Bloem and La Heij (2003).

3.2 Phonological encoding and syllabary access

3.2.1 Orthographic priming

Schiller continued his research on orthographic priming. Earlier findings suggested that masked orthographic primes are transcoded via grapheme-to-phoneme conversion rules into phonological segments, which preactivate segments for the to-be-named target stimulus. Recent experimental data showed that this is not only the case when the target is a picture, but also when the target is a word. Although Dutch is known for its rather shallow orthography, the pronunciation of Dutch words starting with the letter C is only determined by the following segment. If this segment is a back vowel (e.g., /ɔ/) or a consonant, then the onset C is pronounced as /k/ (e.g., *congres* 'congress' or *creatie* 'creation'). If, however, the C is followed by a frontal vowel (e.g., /ɛ/), then the onset C is pronounced as /s/ (*cement* 'concrete'). This makes it possible to vary phonological (P) and orthographic (O) prime-target overlap independently. In a word-naming experiment, Schiller tested this using, for example, the target *congres* and primes such as CANVAS (P+O+), CEMENT (P-O+), KACHEL (P+O-), GRENDEL (P-O-), and a string of percent signs (control).

Compared with the control condition, significant form-priming effects were obtained in the P+ conditions, but not in the P-O+ condition. In fact, this condition did not differ from the P-O- or the control condition, leaving no role for orthographic priming in this experiment. These findings will be further investigated with crosslinguistic experiments.

3.2.2 Time course of computing phonological words

Schiller and Levelt, in collaboration with Schmitt and Peters (both Maastricht U.), showed that lexical stress is assigned from the beginning of a word to its end, supporting the rightward incrementality assumption for phonological encoding made by WEAVER++ (see Annual Report 2001). Together with van Wilgenburg (U. Utrecht), who was on an internship at

the Institute, Schiller showed that the original results by Wheeldon and Levelt (1995) concerning the time course of segmental encoding could be replicated with a different paradigm. Whereas Wheeldon and Levelt used an English-to-Dutch translation-naming task to elicit their internal monitoring responses, Schiller and van Wilgenburg used pictures. Participants were instructed to indicate by means of a button press whether or not a particular target segment was contained in a given picture name. Generally, reaction times (RTs) were shorter when the target segment occurred at the beginning of the picture name than when it occurred at the end. This result replicates Wheeldon and Levelt's (1995) data with a different paradigm and demonstrates that the translation-naming task is a valid paradigm for investigating speech production processes. However, the new monitoring results showed an RT decrease when the target segment was in the final position of the picture name compared to the prefinal position, whereas Wheeldon and Levelt still found an (nonsignificant) increase in RTs. One account for this difference may be that specific segments caused the relatively fast reactions to targets in the final position. Due to strong constraints on the choice of pictorial stimuli and to Dutch morphophonology (polysyllabic Dutch words generally end in weak syllables), many picture names ended in /-ər/ or /-əl/. This possibility is currently being investigated by Vroomen (U. Nijmegen) during her internship at the Institute, using the English-to-Dutch translation task. These and other issues in phonological encoding were extensively discussed with Zwitserlood (U. Münster), who spent a sabbatical at the Institute as a guest of the Utterance Encoding Project.

3.2.3 Seriality of phonological encoding in naming objects and reading their names

A widely accepted but little tested view holds that phonological encoding mechanisms are shared between naming objects and reading their names. Moreover, in models of object naming such as WEAVER++ it is assumed that phonological forms are planned serially, whereas models of oral reading often assume that forms are planned in parallel. Roelofs conducted a series of experiments to test the shared versus separate and the serial versus parallel views. Participants named pictures or read words in blocks of trials where the responses shared the beginning (e.g., CAT, CAP, CAN) or end (e.g., CAT, BAT, FAT) of their form, or where there was no form overlap (e.g., CAT, HOUSE, BAR). Trials were blocked by task. Compared to the condition without overlap, naming and reading latencies

were shorter when the responses had beginning but not when they had end overlap. This shows that the seriality of encoding inside a syllable previously observed (e.g., Meyer, 1991) is obtained for both naming objects and reading their names. Naming and reading latencies were also shorter when disyllabic responses shared the first syllable but not when they shared the second syllable (cf. Meyer, 1990). Moreover, this effect was also obtained when object naming and reading trials were mixed rather than tested in separate blocks of trials. These results suggest that a single, serial phonological encoding mechanism is shared between naming objects and reading their names.

3.2.4 Effects of syllable frequency

According to the theory implemented by *WEAVER++*, syllables play a crucial role at the interface of phonological and phonetic encoding. At this interface, abstract phonological syllables are translated into phonetic syllables. It is assumed that this translation process is mediated by a mental syllabary. Rather than constructing the motor programs for each syllable on-line, the mental syllabary is hypothesized to provide precompiled gestural scores for syllables.

If the mental syllabary consists of programs for syllables, their retrieval should be sensitive to the frequency of use of the programs. Thus, syllable frequency effects would support the notion of a mental syllabary: High-frequency syllables are predicted to be retrieved and produced faster compared with low-frequency syllables. Levelt and Wheeldon (1994) obtained such a frequency effect, but later studies did not. In her dissertation work, Cholin obtained new evidence for syllable frequency effects using a new technique and better controlled materials.

Experiments consisted of alternating learning and test phases. Item sets consisted of pairs of either high- or low-frequency syllables; the segment frequency across item sets was controlled. In the learning phases, participants associated auditorily presented monosyllabic (Experiment 1) or disyllabic (Experiments 2 and 3) nonwords with two different spatial positions on the screen. In the test phases, one of the two positions was visually cued on the screen and participants were instructed to respond with the associated nonword. In the first experiment using high- and low frequency monosyllables, a significant frequency effect was obtained. Experiments 2 and 3 examined whether this effect persisted for disyllabic nonwords. Experiment 2 contained disyllabic nonwords in which the

second syllable was either high or low frequent and the frequency of the first syllable was held constant. Here, no frequency effect was obtained. Experiment 3 contained disyllabic nonwords in which the first syllable's frequency was manipulated and the frequency of the second syllable was held constant. With these materials, again a significant syllable frequency effect was obtained. The results for the disyllabic nonwords suggest that speakers may already start articulation after the first syllable motor program is retrieved, in line with the results of Meyer, Roelofs, and Levelt (see Annual Report 2001). Overall, the results from Experiments 1-3 support the notion of a mental syllabary.

3.3 Multiple word utterances

3.3.1 Planning complex spoken numerals

Meeuwissen continued her dissertation project using the eye-tracking method to investigate the naming and reading of complex numerals. In two earlier studies (see Annual Report 2001), she showed that different planning levels are engaged in spoken numeral production depending on the response mode (house number vs. clock-time naming) and perceptual input format (Arabic digit vs. alphabetic). A new study examined whether planning the form of spoken numerals proceeds serially or in parallel. Speech onset latencies and viewing times may dissociate in that viewing times may reflect the phonological length of the utterance even when speech onset latencies do not (cf. Levelt & Meyer, 2000). Therefore, Meeuwissen measured both speech onset latencies and viewing times.

The results revealed a dissociation between the two measures. Whereas viewing times consistently reflected seriality effects (e.g., viewing times increased with increasing utterance length), speech onset latencies did not. In particular, clock-time naming latencies varied with utterance length whereas house-number naming latencies did not. Overall, these findings suggest that planning the form of complex spoken numerals happens serially rather than in parallel. Moreover, the results suggest that measuring both speech onset latencies and viewing times provides a more reliable picture of word-form encoding in spoken numeral production than measuring speech onset latencies only.

3.3.2 Determiner congruency

Schiller, in collaboration with Caramazza (Harvard U.), continued to investigate the determiner congruency effect. Schriefers (1993) observed

that determiner + noun phrase (NP) production is slowed down when to-be-named pictures are paired with gender-incongruent distractor words as compared to gender-congruent words. He interpreted this effect in terms of gender competition at the lemma level: Gender-incongruent distractor words activate their corresponding gender nodes, which compete for selection with the target's gender node and, resolving this competition, slows down naming.

Recently, Caramazza and collaborators put forward an alternative account for this effect according to which the selection of grammatical features such as gender is an automatic process. However, when the gender-marking determiner has to be selected at the word-form level, competition occurs in the case that more than one determiner form is activated. Schiller and Caramazza (2003) supported this idea with empirical data from Dutch and German. In these two languages, determiner selection is based on the gender of the noun referent only and a selection between different determiner forms must be made: *de* and *het* in the case of Dutch, *der*, *die*, and *das* in the case of German. These conditions must be met to observe effects of determiner congruency. Schriefers' (1993) effect was replicated, but only when singular NPs were produced. In the case of plural NPs, Dutch and German collapse their determiner system to a single form, *de* and *die*, respectively. Although logically not necessary, there is independent evidence that gender is still activated in plural NPs in Dutch and German (Janssen & Caramazza, 2003; Schriefers, Jescheniak, & Hantsch, 2002). Nevertheless, any effect of distractor-word gender disappeared in the Schiller and Caramazza study, supporting the idea that the original effect was due to competition during the selection of determiner forms, and not due to gender node competition.

More recently, Schiller and Caramazza extended their research to determiner selection during the production of diminutive NPs. Diminutives all have the same determiner in Dutch, namely, *het*. Assuming that diminutives, just as plurals, preserve their lexical gender (neuter or common in Dutch), the determiner congruency hypothesis would predict a cost in producing *het tafeltje* ('the_{neuter} small table_{common}') paired with the distractor word *neus* ('nose_{common}') as compared to *oog* ('eye_{neuter}'). The alternative gender-congruency hypothesis (Schriefers, 1993) would predict just the opposite. The experimental results from two experiments supported the determiner congruency hypothesis, but not the gender congruency hypothesis.

3.3.3 Syntactic priming

Syntactic priming refers to the phenomenon of using a particular syntactic structure given prior exposure to the same structure, as first shown by Bock (1986). The locus of this effect has been widely debated with some researchers claiming that the effects are lexically driven while others argue that they are structurally driven. While some results clearly stem from a purely structural manipulation, no results stem from a purely lexical manipulation because all observed syntactic priming effects have been found with sentences or sentence fragment primes. To investigate whether syntactic priming effects can be purely lexically driven, Melinger and Dobel used single-verb primes. They demonstrated that the selection of competing subcategorization frames is influenced by prior exposure to a single-verb prime.

Dutch native speakers were presented with drawings depicting three-participant events that can be described with either double object (DO) or prepositional (PP) structures (e.g., 'The boy gives the woman some flowers' vs. 'The boy gives some flowers to the woman'). Before each drawing was presented, speakers read ditransitive verbs that are restricted either to a PP or DO construction (e.g., *vervoeren* 'transfer' (PP only) vs. *weigeren* 'refuse' (DO only)). If lexical features are sufficient to drive syntactic priming, then the prior activation of one subcategorization frame should make that same frame easier to access than other competing frames that have not been previously activated. Thus, speakers' descriptions should be influenced by the selectional restrictions of the verb prime. Specifically, speakers should produce more DO descriptions of the three-participant scenes following DO-only primes and more PP descriptions following PP-only primes.

Melinger and Dobel found that a single-verb prime is sufficient to bias speakers' preferences for a particular sentence frame. Following verb primes associated only to the double-object subcategorization frame, more pictures were described with a double-object construction than following a control condition or following verbs associated with the dative subcategorization frame.

3.3.4 The production of fixed expressions

According to the superlemma theory of idiom production (see Annual Report 1999), idioms have their own representation in the mental lexicon. These representations are thought to be connected to simple lemmas, that

is, the regular lexical entries that are used in normal, compositional language. In an earlier study (see Annual Report 2000), Sprenger, Levelt, and G. Kempen showed that it is possible to prime simple lemmas via their concepts, in line with the superlemma theory. Idiom production was significantly faster when primed with a word that was semantically related to the idiom's noun. In a new experiment, Sprenger, Levelt, and G. Kempen attempted to reverse this effect by priming the production of single words with the preparation of a word that is part of an idiom. For example, it was tested whether the preparation of "ice" as part of the to-be-produced idiom "skate on thin ice" yields a facilitatory effect on the production of "freeze", which is semantically related to "ice" (the original experimental items were in Dutch). In addition, a phonologically related condition was introduced that served as a control condition for the paradigm ("ice" should prime the word form of "rice"). The results confirmed the predictions. For a relatively early presentation of the target word (200 ms after the preparation of the idiom noun was induced), a semantic priming effect was found. For a later presentation time (300 ms), a phonological priming effect was found. The results support the assumption that during idiom production, simple lemmas are involved that have their own conceptual representation. This results in the activation of the literal meanings of the words that are part of an idiom, even if these meanings are not related to meaning of the idiom itself. For example, when producing "to skate on thin ice" the literal meaning of *ice* will become active.

3.3.5 Clausal coordinative ellipsis

In 1983, Levelt observed a relationship between coordination and self-repairs in spontaneous speech. Self-repairs usually consist of three elements: (a) a reparandum, that is, the original utterance containing an error, (b) an editing term (e.g., "uh"), and (c) a repair text. The speaker interrupts the original utterance, signals this to the listener by means of a pause or an editing term, backtracks to an earlier point in the utterance and reformulates it from there. Levelt noticed that only certain positions in the reparandum qualify as potential "retracing targets", and formulated a descriptive rule demarcating these positions. The rule presupposes that the three basic elements of retracing repairs correspond to three parts of a coordination: the left-hand member, the conjunction, and the right-hand member, as shown in (1). The retracing target in (1a) is the position just before the verb. The fragment preceding this point (i.e., the Subject NP) is

incorporated into the final utterance and, spliced together with the repair text, forms a correct sentence.

- (1a) Jan koopt... eh ...steelt fietsen
 'Jan buys... uh ...steals bikes'
 reparandum *editing term* *repair text*
- (1b) Jan koopt... en ...steelt fietsen
 'Jan buys... and ...steals bikes'
 left conjunct *conjunction* *right conjunct*

In essence, Levelt's rule states that a position within the reparandum qualifies as a potential retracing target if and only if it yields a repair that corresponds to a grammatical coordination. For instance, the position marked by ">" in (2a) is not a potential retracing target because the corresponding coordination (2b) is ungrammatical. In fact, the only permissible retracing target is located at sentence onset, as shown in (2c/d). The symbol "↵" marks the position of the interrupt.

- (2a) *This > man bought ↵
 uh boy stole a bike
- (2b) *This > man bought ↵
 and boy stole a bike
- (2c) >This man bought ↵
 uh this boy stole a bike
- (2d) >This man bought ↵
 and this boy stole a bike

Van Wijk and G. Kempen (1987) observed a second type of correction which they called substitution repairs, (see (3)). These also involve retracing to an earlier point in the utterance but differ crucially from the repairs studied by Levelt: The replacement affects potentially nonadjacent major phrases of the original clause rather than the complete string between the interrupt and the retracing target. Substitution repairs have an analog in coordination as well, see (4).

- (3) De blauwe auto ramde de rode, ik bedoel, de Jaguar de Porsche
 'The blue car rammed the red-one, I mean, the Jaguar the Porsche'
- (4) De BMW botste tegen de Volvo gister, en de Jaguar tegen
 de Porsche
 'The BMW crashed into the Volvo yesterday, and the Jaguar into
 the Porsche'

In the literature on ellipsis ("contraction") in clause-level coordination with the conjunction *and*, one typically distinguishes five different types of phenomena: Forward Conjunction Reduction (FCR), Backward Conjunction Reduction (BCR), Gapping, Subject Gap in Finite/Frontal sentences (SGF), and Left Deletion (LD; also called Right Node Raising, RNR). They are exemplified by Dutch sentences (5) through (9). Substituting the italicized words for the ellipses yields the noncontracted versions.

(5) FCR: *Jan* stal een fiets en verkocht hem onmiddellijk
'*Jan* stole a bike and sold it immediately'

(6) BCR: Jan stal en Piet kocht *een fiets*
'Jan stole and Piet bought *a bike*'

(7) Gapping: Jan *stal* een fiets en Piet een auto
'Jan *stole* a bike and Piet a car'

(8) SGF: Gister stal *Jan* een fiets en verkocht hem onmiddellijk
Yesterday stole Jan a bike and sold it immediately
'Yesterday Jan stole a bike and... sold it immediately'

(9) LD: Jan stal een nieuwe en Piet kocht een oude *fiets*
'Jan stole a new and Piet bought an old *bike*'

G. Kempen developed a model that describes the empirical reasons for distinguishing these types and argued that only the first three can be explained in terms of the parallel between coordination and self-repair: Retracing repairs correspond to FCR/BCR and substitution repairs are analogous to Gapping. This psycholinguistic perspective turns out to enable a theoretically parsimonious analysis of the fine structure of these phenomena. In addition, he proposed an analysis of the two remaining phenomena (SGF and LD).

4 NEUROCOGNITION OF LANGUAGE PROCESSING

The past year marked the final year of the project, the Neurocognition of Language Processing. Throughout 2002 the project members participated in completing the research infrastructure of the F.C. Donders Centre for Cognitive Neuroimaging. The neuroimaging facilities of the center – MEG lab, three ERP labs, and two MR scanners (1.5 and 3 Tesla) – are now fully functional and much of last year's research described below has already been carried out with the new equipment. Although the project as such has come to an end, this research topic, so successfully established in Nijmegen, will continue to thrive in new projects headed by Hagoort, van Turennout, and Indefrey both at the F.C. Donders Centre and the MPI.

4.1 The neural architecture of language processing

4.1.1 Neural correlates of word semantics

Reports on category-specific differences between the cerebral activations evoked by living (typically animals) and nonliving (typically tools) entities seem to depend on the exact nature of the stimuli and the tasks involved. Moreover, the interpretation of fusiform activations that have been observed independent of semantic category is not quite clear since the control conditions did not rule out the option that these activations reflected lexical access rather than the retrieval of semantic information. In order to address these questions, Indefrey and F. Hellwig, in collaboration with Herzog (RC Jülich) and Seitz (U. Düsseldorf) conducted a PET experiment in which they manipulated (a) semantic category (animals vs. man-made utensils), (b) task (silent reading vs. a semantic decision) and

(c) input modality (written vs. spoken words). In addition to a pseudoword baseline condition they presented participants with sentential adverbs, such as *infolgedessen* 'consequently', in a second control condition involving lexical access but no (or only minimal) semantic retrieval. The results showed that bilateral activations of the fusiform gyri for words denoting animals and utensils were independent of input modality and control condition, suggesting that fusiform activations (a) do not reflect modality-specific processing of visual input and (b) do not reflect lexical access. In accordance with the literature, words denoting utensils activated bilateral motor areas more strongly than words denoting animals.

Indefrey and F. Hellwig, in collaboration with Vigliocco and Vinson (both UCL London) and Penke (U. Düsseldorf) completed a database containing weighted semantic features of more than 600 German words. Defining features were collected from 250 native speakers of German. The database provides semantic distance measures that will be used for neuroimaging and reaction-time experiments involving the parametric variation of semantic relatedness.

4.1.2 Functional assessment of hemodynamic activations in neurosurgical patients

To date it is not known which hemodynamic activations observed in language tasks reflect neural activity that is indispensable for language processing and which hemodynamic activations reflect only supplementary neural activity. In epilepsy patients, anterior temporal areas that show fMRI activation during a number of language tasks are often surgically removed. Although some lesion studies have reported mild postoperative language impairments in sentence comprehension, these findings contrast with the clinical observation that language functions are, in general, not affected after surgical removal of the anterior temporal lobe.

Indefrey and Hagoort, in collaboration with Kho and Ramsey (both U. Utrecht), have developed a test battery to assess language function in epilepsy patients after surgery. The test battery includes a standard aphasia test (Aachen Aphasia Test, AAT), a pictorial syntactic comprehension task, and several newly developed tasks addressing prosodic processing and lexical stress discrimination. So far, eight patients who underwent preoperative fMRI measurements with language tasks have been tested two years after surgery. In addition ten healthy controls were tested. In accordance with a previous study, the AAT did not yield evidence for significant language deficits in the classical domains (syntax,

comprehension). However, a high number of errors were made on tasks that require discrimination of syllabic stress and sentence intonation. This impairment was selective, as performance on all other visual and auditory tasks (syntactic comprehension, sentence intonation detection) was normal. These results suggest that the left temporal pole may play an important role in discriminating prosody and intonation. The findings are preliminary and require further testing of the novel tasks in controls and in epilepsy patients prior to surgery.

4.1.3 Neural correlates of bilingual visual word processing

Hagoort collaborated with van Heuven, Dijkstra, and Schriefers (all U. Nijmegen) on a fMRI experiment of monolingual and bilingual reading. Bilinguals are generally unaware that their first language affects reading in their second language. For example, when Dutch-English bilinguals read English words such as *room*, they are usually not aware that this word is orthographically identical to the Dutch word *room*, meaning 'cream'. Nevertheless, behavioral data of bilinguals indicate that recognition of an interlingual homograph is affected by the existence of two readings.

Six highly proficient Dutch-English bilinguals and six monolingual English speakers served as participants. They performed an English visual lexical decision task in a 1.5T Sonata scanner. Low-frequency interlingual Dutch-English homographs were matched in frequency, length and spelling-sound consistency with English control words. Analysis of the (in-scanner) behavioral data for bilinguals revealed significantly slower lexical decision times to homographs than to controls, but no significant reaction time differences for English monolinguals. Bilingual imaging data showed greater activation for homographs than controls in three large clusters (see figure 4.1): One in the left medial frontal gyrus Brodmann Area (BA 6,8) and right superior frontal gyrus (BA 8), and two in the left and right inferior and middle frontal gyrus (BA 46,47,9). In addition, more activation was found in small clusters in the left inferior parietal lobule (BA 40), left superior parietal lobule (BA 7), right supramarginal gyrus, and left lentiform and right caudate nuclei. English monolinguals revealed greater activation for homographs only in a small cluster in a more inferior part of the left BA 47.

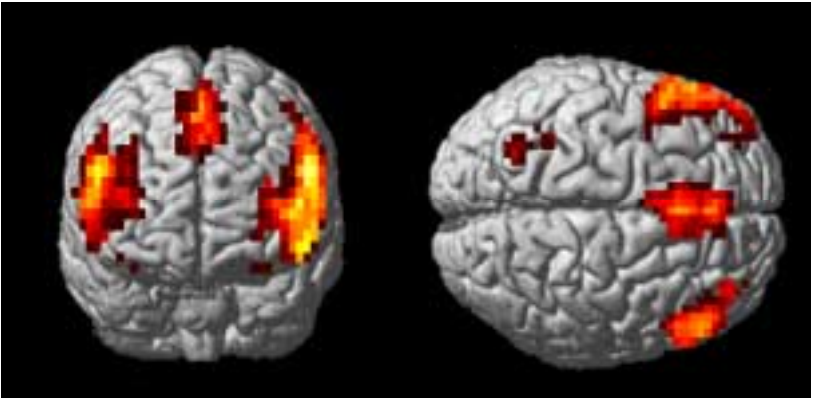


Figure 4.1. Bilingual imaging data: Homographs > Controls

The behavioral results indicate that Dutch-English bilinguals are affected by the Dutch reading of interlingual homographs in an English task. The frontal brain areas that were activated by interlingual homographs are related to output aspects of the visual word recognition process, suggesting that early orthographic representations of interlingual homographs are shared, while output competition and/or phonological aspects of the homographs might have led to the behavioral inhibition effect.

4.1.4 The neural correlates of semantic and world-knowledge violations

It is a long-standing issue whether or not semantic information is pre-packaged into the mental lexicon and more immediately available than world knowledge that is necessary to assign a truth value to a sentence. Following up on the results of ERP studies (see section 4.2.1), Petersson, Hald, Indefrey, and Hagoort investigated this issue in an fMRI study in which subjects read correct sentences, sentences containing a world-knowledge violation, or sentences containing a semantic violation (see examples in section 4.2.1). Both lexical semantic and world-knowledge violations resulted in an N400 effect with identical onset and peak latencies. The size and distribution of these ERP effects were very similar, being maximal over posterior sites. In addition, the lexical semantic violation showed a positive shift between 800 and 1300 ms, also over posterior sites. The fMRI data showed parallel effects in a conjunction analysis that determined the common activation for semantic violations and world-knowledge violations compared to the correct condition. Both violations resulted in an activation of the left inferior frontal gyrus, (BA) 44/45, extending into 46/47. Since the ERP data showed a late positive

shift for the semantic violation compared to the two other conditions, we tested whether there were any commonalities in the fMRI activation patterns between the correct vs. semantic and the world knowledge vs. semantic contrasts. The conjunction analysis showed that with respect to the semantic violations both control words and world-knowledge violations resulted in activation of parts of the left parietal cortex (BA 7, extending into the superior parts of BAs 39 and 40). The fMRI data indicate that not only the integration of semantic information, but also the integration of world-knowledge information engages the left inferior frontal cortex. Post-integration processes might be responsible for the differential activations obtained for semantic and world-knowledge violations.

4.1.5 Neural correlates of artificial-grammar violations

It has been suggested that natural-language processing is a paradigmatic example of the "infinite use of finite means". The family of artificial right-linear phrase-structure grammars (which may be implemented in finite-state machines as formal-language recognizers/generators) is the simplest formal model incorporating the "infinite use of finite means". The task of learning an artificial grammar may be a potentially relevant laboratory model for investigating aspects of language learning in infants as well as second-language learning in adults. Results of an early study (Reber, 1967) indicated that humans can learn some artificial grammars in an implicit fashion and suggested that relevant information can be abstracted from the environment and represented in an implicit learning process that is intrinsic to natural language learning.

In an event-related fMRI study, Petersson investigated, in collaboration with Forkstam and Ingvar (Karolinska Institute), whether aspects of the knowledge acquired about an artificial grammar as measured by grammaticality classification performance are subserved by neural structures closely related to human syntactic processing. Subjects acquired (aspects of) the artificial grammar in an implicit fashion during 3 acquisition sessions in which they were engaged in a short-term memory task using strings generated from the artificial grammar. In the classification sessions in which new (previously unseen) grammatical and nongrammatical items were classified, and during which fMRI data were acquired, all subjects showed a significant above-chance performance on the classification task. In the hemodynamic data, a comparison of the brain activity related to nongrammatical vs. grammatical items revealed that all subjects showed activation of the left inferior frontal gyrus (BA

44/45). This indicates that aspects of the processing of artificial-grammar violations are supported by brain regions known to be related to natural-language syntactic processing. The involvement of the left inferior frontal gyrus (BA 44/45) in syntactic comprehension has been shown to be the most reliably replicated finding across different imaging techniques, presentation modes, and experimental procedures in a recent meta-analysis by Indefrey (see Annual Report 2001).

4.2 Syntactic and semantic integration processes during comprehension

4.2.1 The integration of world knowledge during sentence processing

Following up previous research examining whether world knowledge is integrated online during sentence comprehension, Hald and Hagoort performed an auditory version of a previous visual experiment. The auditory experiment was performed to rule out the possibility that the integration of world knowledge seen in the visual experiment occurred due to the relatively slow word-by-word presentation rate used. By presenting subjects with sentences at a normal rate of speaking this explanation was ruled out. In the ERP experiment, subjects listened to sentences in three conditions as in the following:

- (a) De stad Amsterdam is heel OUD en mooi. (correct)
'The city Amsterdam is very OLD and beautiful',
- (b) De stad Amsterdam is heel NIEUW en mooi. (world-knowledge violation)
'The city Amsterdam is very NEW and beautiful',
- (c) De stad Amsterdam is heel DUN en mooi. (semantic violation)
'The city Amsterdam is very THIN and beautiful',

The critical condition (b) was used to test whether a typical N400 is elicited by a sentence that only violates world knowledge. An N400 was found for the world-knowledge condition that was comparable to the N400 found in the semantic condition, replicating the visual version of the experiment (see figure 4.2 below). These results suggest that world knowledge is integrated within the same time course as lexical semantic information during sentence comprehension.

4.2.2 Contextual influences in the recognition of spoken words

Van den Brink, under the supervision of Hagoort, continued her dissertation work on the time course of contextual influences in the online

recognition of spoken words, using ERPs. An experiment was designed to investigate the time course of phonological, semantic and syntactic influences on lexical selection and integration processes in spoken-word recognition. Subjects were presented with constraining spoken sentences that contained a critical word that was either (a) congruent, (b) semantically and syntactically incongruent, but beginning with the same initial phonemes as the congruent critical word, or (c) semantically and syntactically incongruent, beginning with phonemes that differed from the congruent critical word: e.g., "The woman swept the floor with an old *broom/brooded/messed* made of twigs". Syntactic incongruency was realized by means of a word-category violation (verb instead of noun), which became detectable on an average of 330 ms after critical-word onset. Relative to the congruent condition an N200 effect related to the lexical selection process (cf. Annual Reports 1999 and 2000) was obtained in the semantically and syntactically incongruent condition where word onset differed from that of the congruent critical word. Both incongruent conditions elicited a large N400 followed by a Left Anterior Negativity (LAN) time-locked to the moment of word-category violation and a P600. These results show that different sources of information are processed the moment they become available. The results are in accordance with interactive models of spoken-word recognition but difficult to reconcile with syntax-first models.

4.3 The time course of lexical access during word comprehension

Müller, under the supervision of Hagoort, further investigated the dynamics of access to lexical information in reading single words. In a previous EEG experiment where participants read single Dutch nouns (see Annual Report 2001), Müller had found evidence for lexico-semantic information being available earlier than lexico-syntactic information (here, grammatical gender). Roelofs subsequently showed in a simulation study that his WEAVER++ model could accommodate this finding. WEAVER++ also suggests that gender information can be made available earlier by priming. To test this hypothesis, a new EEG experiment was set up, where a prime was presented that either had the same or a different grammatical gender (congruent/incongruent). In a two-choice go/nogo task, the target's grammatical gender determined the response hand (left/right) and its semantic category determined whether the response had to be executed or not (go/nogo). In the previous experiment the same task without primes

had failed to elicit response preparation on nogo trials as measured by the Lateralized Readiness Potential (LRP): the semantic information determining not to execute the response had been available before the gender information necessary to start the response preparation. In the new experiment, a gender-congruent prime is expected to make gender information available earlier, thus leading response preparation to start on nogo trials before inhibition by semantic information sets in. This should result in a significant LRP on such congruent nogo trials. A behavioral pretest with a simple gender-decision task and primes showed a reaction time advantage for congruent vs incongruent primes. The data analysis for the EEG experiment is currently in progress.

4.4 Event-related oscillatory EEG responses during sentence processing

The aim of this project is to identify frequency-domain correlates in the human EEG of different aspects of sentence processing. Initially, the focus has been on the analysis of the reactivity, in terms of amplitude, of various EEG rhythms (theta, roughly from 4–7 Hz, alpha, roughly from 8–12 Hz, and gamma, roughly from 30–80 Hz) during sentence processing. Previous research (see Annual Reports 2000 and 2001) showed that induced amplitude changes in the theta frequency range, but not in the alpha frequency range, are sensitive to various aspects of sentence processing.

Bastiaansen, in collaboration with Coles (U. Illinois), investigated the extent to which the Error-Related Negativity (ERN), a component of the ERP, can be explained in terms of a phase resetting of the theta rhythm. Preliminary results show that this indeed may be the case, but analyses are still in progress.

In order to keep up with the rapid advances in this field of EEG research, significant effort was put into developing and implementing new analysis procedures. Bastiaansen, in collaboration with ANT Software BV, implemented different types of procedures for analyzing the reactivity of oscillatory responses both in terms of phase modulation (phase-locking statistics, event-related phase coherence, event-related phase resetting) and in terms of amplitude modulation (event-related coherence). In collaboration with Jensen (F.C. Donders Centre, Nijmegen), wavelet-based time-frequency (TF) analysis was implemented as an additional measure of event-related amplitude modulation of EEG oscillations.

The TF-analysis procedure was extensively tested by reanalyzing a data set which was previously analyzed with Induced Band Power (IBP) analysis (see Annual Report 2001). This analysis involved contrasting EEG amplitude changes in the theta frequency range induced by open-class words to those induced by closed-class words. It was concluded on the basis of this methodological study that IBP and TF analysis yield virtually identical results, the difference being that, in contrast to IBP analysis, TF analysis provides a better view on the dynamics of a large frequency range. This makes TF analysis the preferred analytic approach.

In collaboration with Hald and Hagoort, Bastiaansen analyzed data from an EEG experiment in which subjects read correct sentences, sentences containing semantic violations, or sentences containing world-knowledge violations (see examples in section 4.2.1). Figure 4.2 shows that world knowledge violations result in a slightly larger theta power increase, which gradually develops into an alpha-power increase. In addition, there is gamma activity (around 35-40 Hz) in this condition throughout the entire poststimulus interval with a marked peak at 500 ms. In the semantic-violation condition there is a strong theta-power increase and virtually no activity in the gamma range. These qualitative differences contrast with the ERP results, which show an identical N400 effect for both violation conditions.

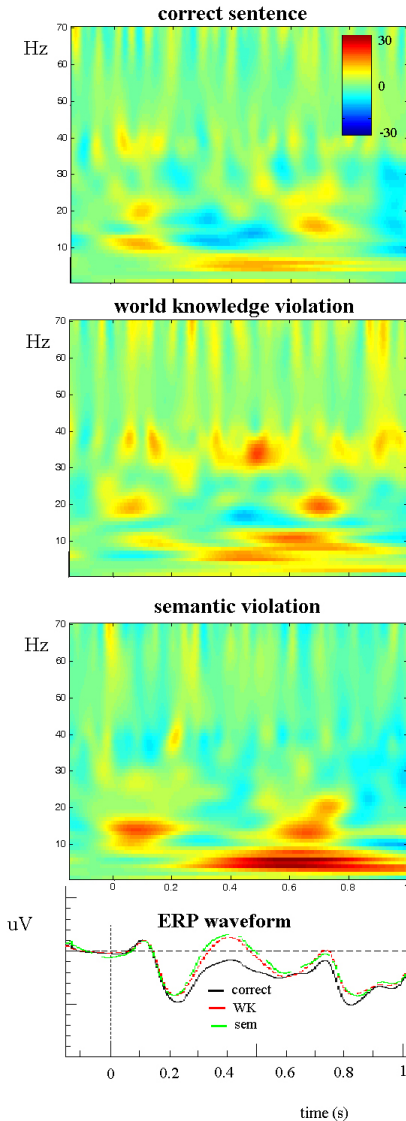


Figure 4.2: Time-frequency representations (TFRs) of the relative power changes occurring after presentation of the critical words in different sentence conditions. At the bottom of the corresponding event-related potentials (ERPs) for all three conditions are shown. For the TFRs, the x-axis represents time in seconds, the y-axis represents frequency in Hz, and the color codes for percent power change relative to a 150 ms prestimulus baseline.

5 MULTIMODAL INTERACTION

The new Institute project Multimodal Interaction aims at studying human interaction from both a multimodal and a multidisciplinary point of view. The project's title summarizes the twin idea of interest, namely that language is fundamentally both *multimodal* and *interactional* in its structure, acquisition, comprehension, and production. Human communication normally takes place as an on-line activity of coordinated action between individuals, in which the unfolding of time is an ever-present factor, and in which all semiotic resources are potentially relevant. Multiple signals are orchestrated in production and simultaneously perceived in comprehension, and interlocutors employ fine mechanisms for regulation of the interaction.

Core members of the project (P. Brown, Enfield, Gullberg, Levelt, Levinson, de Ruiter, Senft) come from different scientific backgrounds, both from descriptive/observation fieldwork traditions and from controlled experimentation traditions. One aim of the project is to pursue the productive integration of quantitative (balanced, controlled, experimental) and qualitative (ecologically valid/authentic, spontaneous, descriptive) methodologies. Project work in two subprojects has begun and a number of further subprojects are being developed, including the study of turn-taking in conversation, interactional meanings in semantics, pragmatic inference, and interactional functions of cospeech gesture, facial expression, and gaze.

5.1 Multimodal interaction in a route negotiation task: The SLOT Laboratory

De Ruiter has built a laboratory for the SLOT (Spatial Logistics Task) research paradigm, which was developed for use in the EU-funded Conversational Multimodal Interaction with Computers project (COMIC). The partners of COMIC (MPI Nijmegen, U. Nijmegen, U. Sheffield, U. Edinburgh, DKFI Saarbrücken, MPI Tübingen and Visoft GmbH) are joining efforts in designing a Computer Aided Design (CAD) system that interacts conversationally and multimodally with a human user. The task of the MPIs in Nijmegen and in Tübingen is to do fundamental research on human – human multimodal interaction, generating the knowledge needed to make the interactive CAD system behave as humanlike as possible.

In the SLOT paradigm, two participants negotiate a route through a city, using a shared whiteboard to facilitate the negotiation process. The interaction is recorded using three video cameras and a digital real-time registration of the shared whiteboard. (For a screen shot of SLOT data see figure 5.1).

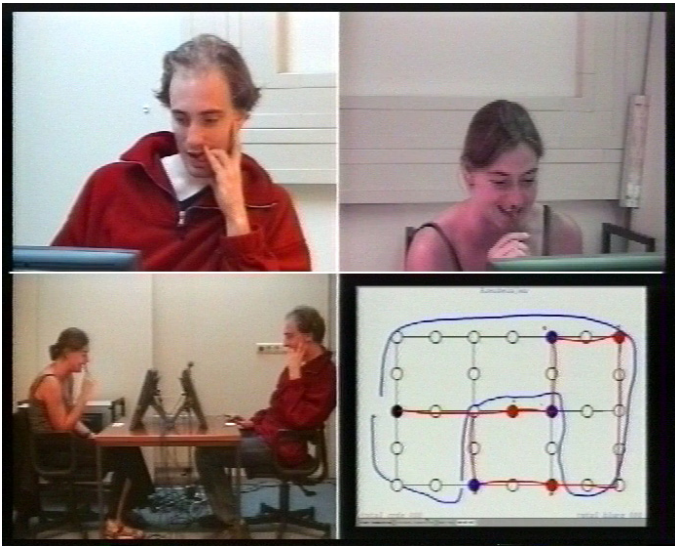


Figure 5.1: A snapshot from recorded SLOT data.

In order to investigate a comprehensive range of specific communicative features of the interaction the resulting data stream is being transcribed in painstaking detail. Table 5.1 presents an overview of the behavioral categories that are being coded for both participants.

CODED FEATURE	EXAMPLE VALUE
Transcription of speech	"let's go this[x] way, ok?"
Use of pen on whiteboard	Trajectory[x]
Speech affiliate of pen usage	"this[x]"
Speech act	Proposal of specific route
Upper face	Eyebrows up
Lower face	Corners of mouth down
Posture	Leaning backwards and to the left
Head motion	Tilting head to the right
Eye gaze	Gaze at interlocutor

Table 5.1: The corpus of richly transcribed data from SLOT experiments will enable the investigation and modeling of a broad range of phenomena in multimodal interaction from both qualitative and quantitative perspectives. The [x] index is used to establish relationships with other coded features.

5.2 Regulation of turn-taking in nonverbal interaction: Two-person weaving in Laos

The mechanism whereby an interactant's anticipation of another's incipient action is used in the regulation of interactional timing has long been a topic of research in conversational analysis. One motivation for studying interaction that does *not* necessarily involve speech is to provide a baseline for the investigation of linguistic interaction as joint activity, in terms of (a) timing in turn-taking, (b) nonverbal cues for regulation of interaction, (c) gaze behavior in perceptual monitoring of interaction. Enfield conducted a preliminary field investigation of a traditional form of coordinated manual activity in rural Laos (reed-mat weaving; see figure 5.2).

Video recordings were made in two spontaneously occurring conditions. In one condition ("two experts"), the participants were both experts who had worked together before. In a second condition ("one novice"), one of the participants had little or no experience. One difference between these two conditions concerns the amount of common ground with respect to knowledge and experience of the procedure. Particular actions by one participant are preconditions for particular actions by the other. Participants must therefore attend to the progress and completion of each other's actions in order to time their own actions and to achieve smooth coordination. Table 5.2 lists key performance differences between the two conditions.



Figure 5.2: Lao villagers coordinating their actions in weaving reed mats. A single mat is woven on this apparatus by the simultaneous and coordinated actions of two people: one is responsible for feeding individual reeds in between warp threads (left), while a second uses a wooden block to work each reed into the mat, tying off each reed at alternate sides (right).



Figure 5.3: In the "one-novice" condition, a novice (leaning rightwards, white T-shirt) is tying off two-handed (experts do this one-handed), while the expert (seated, left) and a bystander are visually monitoring his progress while waiting for completion of his turn. Experts do not normally monitor other experts' tying off.

	TWO-EXPERTS CONDITION	ONE-NOVICE CONDITION
Use of speech for coordination of actions	occasional	constant
Response by expert to delays in completion of action by other participant	tolerant, patient waiting, no comment on delay	no waiting for novices to complete before instructing them on how to do so, often comment on the delay
Timing of turn-taking between other dependent actions	good: fast, rhythmical, execution of subsequent turns under way before other's prior turn fully completed	poor: slow, often showing failures in coordination, one participant often left waiting (see figure 5.2)
Perceptual monitoring	minimal	constant (see figure 5.3)

Table 5. 2: Some key differences in interaction between two conditions

Smoothness and good timing in turn taking in the two-experts condition suggests that participants were successfully anticipating (or "projecting") the moment at which the other's action (prerequisite to their own) would be completed. Similarly, many of the problems in the one-novice condition were due to unfulfilled or mistaken anticipation of what the other would do (for example, beginning execution of one's own turn before the other's was fully completed, only to find that they do not complete it in the proper way). The data reveal that even with a very simple and predetermined task structure, the coordination of joint actions is surprisingly complex.

Early results of these two subprojects demonstrate that speech is just one of the types of signal used in the coordination of behavior in interaction. The mat-weaving data demonstrate a stripped back turn-taking system in which verbal communication need not even play a role. Such data allow us to consider some basic-level aspects of behavior which regulate coordination of action between interactants (for instance the importance of visual attention in monitoring progress of the interaction). The SLOT data demonstrate a richer type of multimodal interaction, where speech and diagrammatic representation are focal and where bodily behavior is also contributing to the communication. It is clear that the different modalities involved do not each act as truly independent semiotic systems, as the

predominantly verbal modalities such as speech or writing are generally assumed to. Rather, in interaction, including in ordinary conversation, signals in one modality can constrain, modify, and/or determine the meaning of signals in other modalities.

6 GESTURE

The Gesture Project investigates the use of the visuomotor modality in linguistic communication and the underlying mental processes for such use. Research has been conducted on both spontaneous cospeech gesture and sign language. With respect to spontaneous cospeech gesture, the project continued the investigation of the relationship between speech production and gesture production, via three lines of research. First, the coordination of information expressed in gesture and in speech has been investigated from three different perspectives: the expression of motion events by children (6.1.), reference tracking in second language narrative (6.2), and the indication of location and directions in the description of local environment (6.3). Second, theoretical questions about models of gesture production have been addressed. More specifically, it has been investigated how the load on conceptual planning for speaking influences gesture production (6.4), and how the self-monitoring process encompasses both speech and gesture production (6.5). In addition to the investigation of the speech-gesture relationship, gesture has been explored as a representational system on its own by investigating the nature of semiotic mechanisms underlying gestural expressions of three dimensional objects (6.6). As for sign language, the question of how deaf children's language development is influenced by the nature of the communication system that they learn has been investigated (6.7). More specifically, children learning sign language of the Netherlands are compared to those learning Sign-Supported Dutch (SSD).

The interest in the visuo-motor modality in linguistic communication spans multiple Institute projects investigating related issues. In particular, the Space Project (see Chapter 7.2 and 7.9), the newly founded Multimodal

Interaction Project (Chapter 5), and the Event Representation Project (Chapter 9) survey issues closely related to those investigated in the Gesture Project.

6.1 Informational coordination between speech and gesture in motion-event descriptions by Turkish children and adults

Özyürek (Koç U.), Kita, Allen (Boston U.), Kokal (Koç U.), Turanlı (Koç U.), and A. Brown (Boston U.) investigated how Turkish-speaking adults and children coordinate information encoded in gesture and speech in their descriptions of motion events. In describing motion events, two simultaneous aspects of an event, namely manner and path, have to be decomposed and linearized in speech. Different languages use different syntactic means to do so (e.g., Talmy, 1985). While English speakers can express both elements in one clause (e.g., "the ball rolls down the hill"), Turkish requires two separate clauses, typically in a matrix-subordinate clause construction (e.g., "the ball descends while rolling"). Previous research has shown that gestural representation of manner and path parallels these lexical semantic differences (Annual Reports 1998, 2001). Turkish speakers express manner and path in separate gestures more often than English speakers, who use mostly gestures that represent the two elements simultaneously. Thus Özyürek and coworkers investigated how Turkish children learn to coordinate motion event expressions in speech and gesture where they have to use two separate clauses and two separate gestures for manner and path.

Data were taken from 20 Turkish-speaking children in three age groups, ages 3, 5, and 9, and 20 adult Turkish speakers. Each subject was shown animated video clips of motion events featuring both manner and path. Later he or she narrated the story to a listener. For speech, each sentence was coded for whether the subject expressed

- manner only in a separate independent clause (e.g., "the ball rolled")
- path only in a separate independent clause (e.g., "the ball descended")
or
- both of the semantic elements in a matrix-subordinate construction (e.g., "the ball descended rolling").

Gestures were categorized into three types: manner-only (e.g., hand rotating in place), path-only, (e.g., hand tracing a downward path) or a

conflating gesture (e.g., hand tracing a downward path while simultaneously rotating).

The results showed that the proportion of sentences in which a single semantic element was expressed in an independent clause decreased with age; specifically 3- and 5-year-olds expressed single elements significantly more than adults did. Adults and 9-year-olds instead preferred to use mostly matrix-subordinate clause constructions where both manner and path are expressed in one sentence and significantly fewer sentences that convey a single element. In terms of gestures there were no significant differences across age groups, that is, the proportion of manner-only, path-only and combination gestures remained the same across ages. However, how information was distributed across speech and gesture changed across ages. When a sentence encoding only a single element is uttered, 3- and 5-year-olds were significantly more likely to compensate this with different information in gesture than adults. For example, when path was the only information conveyed in speech, 3- and 5-year-olds were more likely than adults, to convey manner information with manner-only gestures. 9-year-olds did not differ from adults in this respect.

These results suggest that young Turkish children cannot express both manner and path within a sentence, due to syntactic complexity and processing limitation (See also section 9.3.3). Thus, they use simpler speech, expressing one of the two elements, and express the unspoken element in gesture. In contrast, for adults' and 9-year-olds' speech and gesture, the information in the two modalities parallel each other even when they express single information. Adults and 9-year-olds choose to express a single element in an independent clause when there is a discourse-level motivation (i.e., focusing), and thus the speech need not be compensated by gesture. These results are consistent with the earlier findings that an increase in informational discrepancy between speech and gesture indexes transitional stages in cognitive development (e.g., Piagetian conservation task, Goldin-Meadow et al, 1993) as well as in early language development (e.g., transition from one-word to two-word utterances, Goldin-Meadow & Butcher, in press). Similarly, Özyürek and coworkers argue that before Turkish children solve the linguistic puzzle of expressing manner and path in one sentence, they attempt to express one element in gesture and one in speech.

6.2 Overexplicit reference tracking in second-language speech and gestures

All second-language (L2) learners have difficulties creating cohesive discourse and particularly deploying anaphoric linkage or reference tracking in a targetlike manner. Early L2 speech, regardless of the first and second languages involved, is typically coreferentially overexplicit such that maintained referents or topic elements in speech are overmarked by full NPs rather than pronouns or zero anaphora. In a previous study, Gullberg has shown that the overexplicit spoken learner variety of anaphoric linkage (cf. *The Dynamics of Learner Varieties*, Chapter 11) is mirrored by a coreferentially overexplicit gestural variety (Annual Report 2001). Native speakers map discourse referents onto space by associating new referents with specific loci in space using localizing gestures. In contrast, learners do not only anchor new referents, but also indicate the loci of maintained referents with anaphoric gestures at every mention. Maintained referents are thus overmarked in both speech and gesture. It has been suggested that this bimodal overexplicitness is an interactionally motivated learner strategy designed to disambiguate referential expressions for the benefit of the addressee. Gullberg examined this contention by investigating the speech and gestures of Dutch learners of French who retold stories to addressees they either could or could not see.

The results showed that learners' tendency towards coreferential overexplicitness was largely unaffected by variation in visual access to the addressee. Speech was equally overexplicit in both visibility conditions. Despite an overall tendency for learners to produce fewer gestures overall in the nonvisibility condition, their gestural overmarking of maintained referents was not *quantitatively* affected. However, there was a *qualitative* effect in that these tracking gestures were less spatially distinct when addressees could not see them. The results suggest that learners' gestural overexplicitness is multifunctional. Learners do exploit gestures and spatial anchoring to visually track referents for disambiguating purposes when these are visible to the addressee. However, learners also appear to externalize discourse referents for speaker-internal reasons, possibly as a means of reducing planning load in L2. Gestures and spatial locations could serve as an external memory device that would free up processing capacity and thus allow the learner to plan and produce the subsequent item in L2 speech.

6.3 Hand pointing in Laos: form and function in a locality description task.

Enfield and Kita investigated formal variation in hand pointing, and asked whether certain distinctions – specifically, whether the arm is fully raised or not during the pointing gesture – corresponded with other distinctions in verbal and nonverbal aspects of communication. Enfield collected video recordings of outdoor interviews with Lao villagers about the history of their local area. The interviews elicited many pointing gestures oriented toward real objects or locations. They were able to identify 102 hand gestures and coded them for two formal features: first, position of the arm performing the gesture ("elbow up" versus "elbow down"), and second, orientation of the head ("towards the target" vs. "not toward the target", allowing for loose inference of gaze direction). Figure 6.1 shows that while the number of elbow-up and elbow-down gestures was not much different (46 vs. 56), there were two significant correlations between elbow position and head orientation. First, when the elbow is up, mostly the head is oriented toward the target (as in figure 6.2). Second, when the head is not oriented toward the target, mostly the elbow is down (as in figure 6.3).

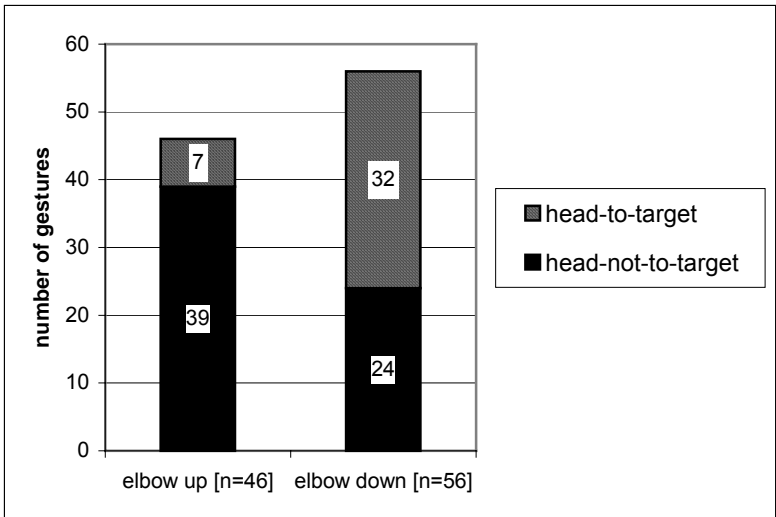


Figure 6.1: Number of gestures in which elbows are up or down and in which the head is oriented toward the target or not.



Figure 6.2: An example of a gesture with the features: elbow-up, head-to-target. The gesture followed the interlocutor's question, "where's the school", and cooccurred with the answer, "towards the bottom of the village here".



Figure 6.3: An example of a gesture with the features: elbow-down, head-not-to-target. The gesture cooccurred with an utterance, "you have to go past Somsamai Village."

Furthermore, the formal distinction of elbow-up versus elbow-down was found to correlate with a distinction between two types of linguistic utterance with which the gestures occurred. Elbow-up pointing gestures tended to occur in *location-focus* contexts, i.e. where the primary function of the utterance is to tell the addressee where something is (see figure 6.2, above). Elbow-down pointing gestures tended to occur in *insecure-reference* contexts, i.e. where the speaker is not fully confident that there is sufficient common ground in the context for the addressee to converge with the speaker on an intended referent. The result is summarized in figure 6.4.

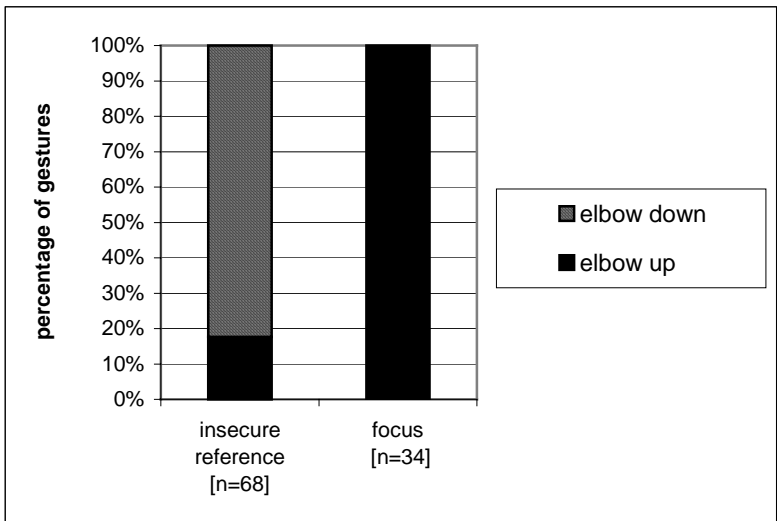


Figure 6.4: proportions of elbow-up and elbow-down gestures in insecure-reference contexts and in location focus contexts.

Elbow-down pointing occurred in a range of situations, including (a) asking for or offering clarification of reference, (b) introducing a new referent with a recognitional expression such as a proper name, (c) using a linguistic expression with ambiguous or insufficient information. A possible explanation for the form-function correlation in figure 6.4 is that the perceptual salience of a larger pointing movement is iconically related to the foregrounded status of directional information in the utterance.

6.4 Gesture and cognitive complexity

Melinger and Kita continued their investigation of the speaker-directed function of cospeech gestures. Specifically, their investigation focused on the correlation between gesture frequency and increased processing demands. They collected descriptions of networks of colored circles and compared situations in which speakers produced gestures to situations in which they did not. Prior analyses demonstrated that conceptually more challenging pictures elicited more cospeech gestures than conceptually less challenging pictures (see Annual Report 2001). Further analyses were conducted to determine whether this difference was driven by factors associated with increased linguistic formulation difficulties (i.e., thinking-for-speaking) or more general cognitive processes.

Melinger and Kita hypothesized that these two possibilities could be disentangled by comparing the distribution and frequency of gestures produced by speakers who describe the networks from the intrinsic vs. deictic perspective. Formulation difficulties may be encountered for intrinsic descriptions because they require speakers to update their choice of appropriate directional terms for each movement within the network while deictic descriptions do not. Thus, if factors tied to complexity stem from thinking-for-speaking processes, speakers who adopt the intrinsic perspective should produce more gestures compared to speakers who adopt the deictic perspective for those subparts of the network that require spatial reorientation (e.g., when the directional term used to express a movement does not match the objective direction presented in the image; the path leads *left* but the appropriate directional term is *right*.) Surprisingly, however, a series of detailed analyses failed to reveal an effect of perspective on gesture production, although further evidence was found in line with results reported in the Annual Report 2001, for a general effect of increased cognitive processing demands. Melinger and Kita interpret this finding in line with the notion that gesture production generally reduces cognitive load (cf., Goldin-Meadow, Nusbaum & Kelly, 2001) and therefore is evoked at moments of general cognitive complexity.

6.5 Self-monitoring for errors in gesture

Seyfeddinipur extended her analysis of disfluency in speech and gesture, drawing upon the corpus of living space descriptions (see Annual Report 2000). Her analysis focused on disfluencies in the gestural modality. The main questions addressed were 1) whether speakers monitor their gestures,

and 2) whether gestural disfluencies have an impact on concurrent speech just as speech disfluencies have on the gestural modality (see Annual Report 2000).

With regard to the first question, she found that speakers monitor for correctness of the gestural content. For example, a pointing gesture to the left while the intended direction was right is repaired by a new pointing gesture to the correct direction to the right. Speakers were also found to monitor for appropriateness of their gestures so that they could be adjusted according to the recipient's need. For example, a gesture articulated in peripheral space on the lap is suspended and then rearticulated in visually central space in front of the face. Another example is the change of the mode of expression. A gesture in which the hands mould a spatial configuration is suspended and repaired by a new gesture in which the hands trace the outline of the configuration.

Concerning the second question, she found that the above gesture repairs lead to suspension and resumption of the concurrent speech. When gesture is suspended for repair, speech is also suspended. Subsequently when the correction of the gesture is initiated, speech is resumed without any alterations.

To summarize, speakers monitor their gestures for correctness and appropriateness. Furthermore, when they repair their gestures, they also interrupt the concurrent speech. By doing so, they maintain the integrity and consistency of the composite signal as such. Thus, both gesture and speech are regarded as components of the speaker's final product and this final product is monitored as a unity.

6.6 Packaging of 3D spatial information in descriptions of fish traps in Laos

Enfield began a study of the mechanisms by which gestures convey meaning in a specific genre, namely that of describing three-dimensional spatially complex artefacts. Video recordings were made of interviews with Lao villagers, in which they were asked to describe traditional fish trap mechanisms. The interviews were rich in various types of illustrative gestures. Four main observations were made. First, the hands conveyed information about physical objects by employing a range of distinct semiotic functions, including "enacting" (hands depicting doing something to the object), "modeling" (hands "being" the object), "tracing" (2D or 3D

"shaping" gestures demonstrating spatial borderlines), and pointing. These functions were closely coordinated in single sequences. The second observation was that while "gesture space" may appear flat and "disklike" in some genres (McNeill 1992), in these artifact descriptions the gesture space is not only three-dimensional, but is also anchored to the immediate physical environment (e.g., to objects, furniture, the speakers' own bodies). The third observation was a consistent routine of temporal sequencing of the expression of types of shape and spatial information. Speakers repeatedly produced a cycle of "symmetry" and "dominance" with respect to how the two hands were used in relation to each other. A typical example sequence begins with a two-handed gesture in which the hands symmetrically depict two sides of a circular opening in a large basket trap. The nondominant hand is then held motionless where the symmetrical gesture was completed, while the dominant hand is then used to depict further detail or associated information (in this case modeling a fish swimming in through the hole). The held nondominant hand functions to spatially anchor subsequent gestures of the active dominant hand, as well as to maintain a "prosodic" role, signifying that the current stretch of talk is not over yet. The fourth and related observation was that while holding gestures signified "topic continuing", bringing the hands to full rest position was a strong indicator that the current description had come to an end (i.e., "topic closed").

6.7 Early acquisition of Sign Language of the Netherlands and Sign-Supported Dutch

Hoiting and Slobin continued the work on the early acquisition of Sign Language of the Netherlands (SLN) and Sign-Supported Dutch (SSD), as described in the 2001 Annual Report. The following issues received attention in 2002:

Pointing: Children acquiring a natural sign language (SLN) point to objects and persons in visible space, adjusting the angle of the arm to indicate distance. These points serve to refer to objects and persons, predicating location, movement, and manipulative patients. However only children with deaf parents use points to refer to absent persons, and only children learning SLN use points with the punctual, directed prosody of a natural sign language. These children, in contrast to children learning SSD, incorporate points into longer utterances, and often use "copies" of points in a single utterance in order to maintain and focus reference.

These findings indicate that points take on linguistic status in the context of a natural sign language. On all measures, children with deaf parents are in advance of children with hearing parents, but the developmental gap is not large. The performance of hearing parents learning SLN is similarly linguistic in nature, in contrast to parents learning SSD, whose points are more gestural and less focused (ambiguous, multifunctional) and tend not to be integrated into larger linguistic constructions.

Vocabulary: Parental checklists show steady vocabulary growth, but with slow growth and low cumulative vocabulary for children learning SSD, in comparison to SLN. The growth curves for SLN-learning children with hearing or deaf parents do not differ. Generally, nouns and verbs increase at a comparable rate, with evidence for some SLN-learning children of a rapid increase in the verb lexicon after the 50-sign level.

Patterns of communicative interaction: On all measures, parents trained in SSD are less successful in establishing and maintaining meaningful interaction with their children than are parents trained in SLN. The demands of speaking Dutch out loud while producing manual signs results in sign input which is often uninterpretable to the child, regardless of the hearing status of their parents. Hoiting and Slobin have studied sequences of child-directed signing, looking for "variation sets," that is, parental modifications of utterances in sequences of signing devoted to a continuing topic. Such modifications are generally absent in SSD-trained parents, but are common in the signing of both deaf and hearing parents in SLN. Preschool observations show the beginnings of peer-peer communication in children learning SLN, as opposed to the predominance of solitary play or adult-child interaction in SSD.

Morphology: The central focus of the work has been devoted to the analysis and acquisition of polycomponential signs – which are perhaps the most striking grammatical characteristic of signed languages in comparison with the Indo-European languages of the surrounding speech communities. The data show meaningful and productive use of semantic components ("classifiers" or "property markers") as components of polycomponential signs: as early as age 1;10 in children, and in hearing mothers with as little as six months of signing experience. Early learners – child and adult – use property markers that model the shape of the hand that manipulates a referent object ("manipulative handle classifiers") as well as those that model the shape of the object being manipulated ("depictive handle classifiers"), with later acquisition of property markers

that have more abstract representation, such as “inverted-V” for a moving person (two-legged). Nevertheless, such property markers are present in 3-year-old signing, sometimes accompanied by simultaneous inflection for manner of movement – earlier than attested in the literature. Simultaneous inflection for aspect, however, comes later. With regard to coordination of both hands, early learners, especially children, are prone to omit ground reference (nondominant hand). Errors also occur in signs that require conventional articulation on a particular part of the face or body. The data show early command of the movement of signs in space for the representation of physical movement (verbs of motion and translocation), with much later acquisition of movement to represent relations between the arguments of a verb (agreement). Frequency and diversity of property markers increase in the course of learning, with deaf parents showing the most variation in selection of incorporated handshapes, and hearing parents learning SSD showing the least competence in this dimension.

7 SPACE

The Space Project is concerned with how spatial distinctions are represented in cognition, how they are encoded in language, and the relation between these. The first section reports on a new development, the strengthening of the psychological side of the project and its extension into neuroimaging. The next section reports on the use of space in a sign language to indicate spatial distinctions. The six following sections report on research on specific aspects of spatial language. The final section reports explorations in spatial thinking in other (nonspatial) domains.

7.1 Space in Neurocognition (SPIN)

The new research group (Janzen, Haun, with Levinson, Levelt, van Turenout, Hagoort), in examining the neural basis of spatial cognition and spatial language, is attempting to advance psychological and linguistic theories of spatial cognition by relating them to neural processes in the human brain. The study of spatial cognition in humans examines our perception and understanding of the spatial characteristics of our external environment. In order to successfully start a normal day we need to determine where we are, remember the location of a light switch to the right of the bed, move ourselves into a vertical position, plan our way to the bathroom door down the hall and navigate to and through it. All these tasks include several highly complex cognitive processes such as remembering spatial locations and landmarks, updating our body position, wayfinding, locomotion and navigation. Language can abstractly convey spatial information between individuals: for example, giving satisfactory directions to a location. Underlying all these cognitive and language-related spatial processes is a system of frames of reference. Coding space within these different frames of reference requires very different cognitive

processes, which have been linked to differential patterns of neural activation.

The first subproject of the SPIN research group examines people's knowledge of where things are when learning a route through a virtual maze for the first time and from a traveler's viewpoint. By means of a behavioral study and an event-related, functional magnetic resonance imaging (fMRI) experiment the group investigated the representation of objects placed at locations in a spatial environment that differ in their functionality. Previous results concerning the acquisition of route knowledge show that objects such as buildings help to find one's way in an environment. Such landmarks are more helpful and can be better recalled if they are placed near a decision point, as compared to objects located at places where no decision is needed. Decision points are all intersections where alternative routes can be chosen. Therefore, simple turns do not qualify as decision points, whereas going straight at a two-road intersection does. The question is whether remembering objects at decision points, versus objects located at other points along a route, results in differential patterns of neural activation.

Subjects were shown a virtually created trajectory from the traveler's viewpoint through a corridorlike maze. In a simple recognition task ("Was this object in the route or not?"), recognition times showed that participants responded faster when the object was placed at a decision point compared to a nondecision point (Janzen 2000). Objects in the recognition task were shown from a canonical perspective on a white background without any maze-related information. These effects were replicated and were already present after only one single exposure to a virtual maze containing 144 objects, which strengthens the notion that a highly automatic process is involved. The possibility of moving onto another path (i.e., changing direction) accelerates access to object memory whereas the actual movement at a location (right or left turn) does not play a role. These results (figure 7.1) support the theory that the binding of objects to their locations is facilitated by their functionality or navigational relevance.

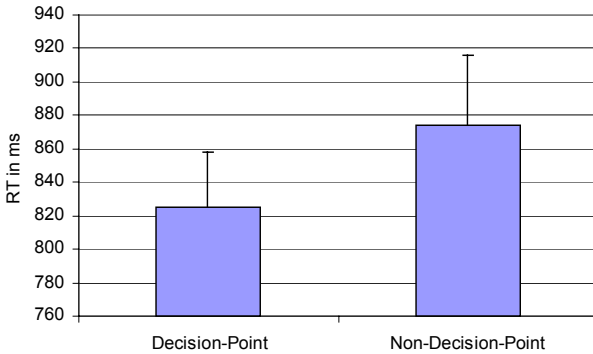


Figure 7.1: Mean recognition times and standard errors (20 participants) for objects at decision and nondecision points with right and left turns at all locations and for all objects

In an event-related fMRI experiment the neural correlates of the effect described above are currently being investigated. Objects placed at decision points should show more activation in the right hippocampal and parahippocampal region, areas which are involved in object-place associations (e.g., Owen et al. 1996; Maguire et al. 1998). Ten right-handed volunteers (5 male and 5 female participants) were scanned during the object recognition task (using the facilities of the F. C. Donders Center for Cognitive Neuroimaging). Functional images of the whole brain were acquired on a 3 Tesla MRI system (Siemens Trio). Figure 7.2 shows parahippocampal activation between decision-point and nondecision-point conditions. Blood oxygenation level-dependent (BOLD) contrast in this area is stronger for objects at decision points compared to objects placed at nondecision points.

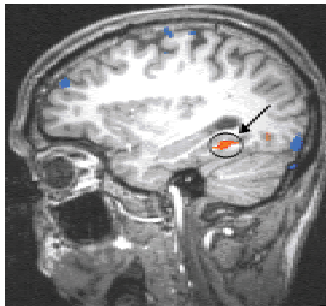


Figure 7.2: Increase in BOLD response in the right parahippocampal gyrus (10 participants) for decision-point objects compared to nondecision-point objects

The results show that right parahippocampal involvement in object-place association is modulated by the specific navigation relevance of an object's location. Moreover, the results support the assumption that the decision-point effect is highly automatic.

7.2 Space in Sign Language

Perniss continued her research on the encoding of spatial relations in signed language, where space itself is used to represent space. Two basic types of spatial representation have been distinguished in this respect: in Liddell's (1994, 1995) terms, "token space" representations are characterized by a topographic use of signing space where the spatial relations between the hands in signing space encode the spatial relations between the referents (see figure 7.3). In contrast, the signer encodes actions and affective displays in "surrogate space" by enacting the actions of an agent (see figure 7.4). Token and surrogate space representations often align with what is known in gesture studies as "observer" and "character perspective", respectively (McNeill 1992).



Figure 7.3: Classifier forms depicting a person (signer right hand) standing in front of a table



Figure 7.4: Signer depicting a character holding a pan

To illustrate (see figure 7.5): if a character turns 90° to the left, this turn can be represented in token space by turning the sign (a so-called "classifier") for an upright person 90° to the left. Assuming a surrogate space representation, the same action by the signer would encode that the character moves *her* hand. To encode the same meaning (the character turning) in surrogate space, the signer would have to turn her own body by 90°, which would be time-consuming and disruptive to the

interaction between signers, and in any event is not licensed by linguistic conventions.

In narrative texts, frequent switches between these two modes of representation are necessitated by physical and linguistic limitations on the articulators (the hands in the case of token space; potentially the entire body in the case of surrogate space). These switches introduce potential ambiguity, often forcing signers to explicitly map the relevant spatial information (locations, orientations, etc.) between token and surrogate space representations.

Perniss identified a mechanism that affords such explicit mappings in German Sign Language (DGS) narratives: so-called "simultaneous constructions", in which distinct lexical elements are produced at the same time by different articulators (e.g., Miller 1994). Perniss observed how such constructions permit encoding of an element from a token space representation by one articulator, e.g., the nondominant hand, simultaneously with an element from a surrogate space representation being encoded by another articulator, e.g., the dominant hand. Token and surrogate spaces are thereby simultaneously activated, such that loci in both spaces can be mapped onto each other, each becoming associated with the same specific spatial information.

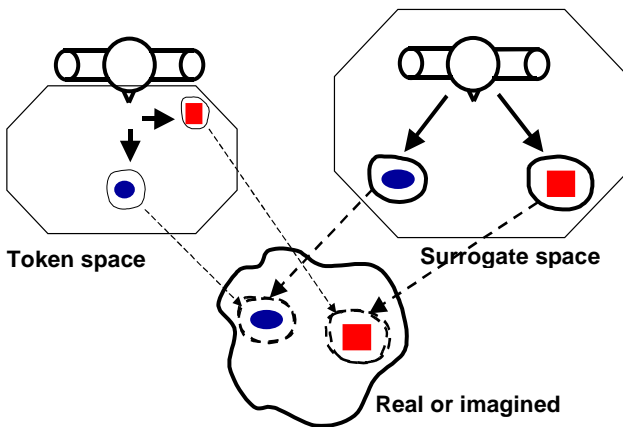


Figure 7.5: Abstract schematization of mapping of loci (for blue and red referents) used in token and surrogate space representations onto conceptualization of event in real or imagined space

7.3 Shape and classifiers

Languages differ in where they encode information about shape. In some languages, ordinary nouns are specific about shape. English distinguishes between a *stick* and a *plank*, even though both are bits of wood. In many languages, however, the corresponding noun might mean "wood", and require additional specification about shape elsewhere in the noun phrase or even in the verb (see section 7.7). Often, classifiers, a special part of speech, play a crucial role here.

Consider the Papuan isolate Yélfî Dnye (spoken on Rossel Island, Papua New Guinea, researched by Levinson). Classifiers for discrete objects in Yélfî Dnye mostly have a shape-specifying semantics (e.g., *pé* 'long thing', *w:uu* 'round thing') or specify shapes of agglomerations (*dyuu* 'small pile', *mbwó* 'large pile', *mtyé* 'cluster'). They occur frequently in counting contexts (as in *chéêpî kpââ miyó* 'stone flat piece two' i.e., two flat stones), like so-called "numeral classifiers", but are neither obligatory in nor restricted to these contexts. Perhaps their main function is to delimit the reference of semantically general nouns, a role also played by positional verbs in the language. So *k:ii* 'banana' can mean the tree, the fruit, the leaf, and is usually classified to specify – when not so classified the 'tree' reading is implicated:

- | | | |
|-----|------------------------------|--------------------------|
| (1) | <i>k:ii miyó</i> | 'two banana plants' |
| | <i>k:ii nt:uu miyó</i> | 'two unripe bananas' |
| | <i>k:ii kigha nt:uu miyó</i> | 'two ripe banana fruits' |
| | <i>k:ii ch:ênî miyó</i> | 'two hands of bananas' |

Most terms for natural kinds have this kind of semantic generality in Yélfî Dnye, and thus often occur in fixed collocations with classifiers, e.g., *chikini w:uu* 'pawpaw seeds', *chikini kighê* 'pawpaw fruits', *chipa w:uu* 'pepper seeds, i.e., edible part'. Classifiers in Yélfî are a special form class of nominals, distinguished by a number of features (e.g., they are not possessable or pluralizable, do not occur in the position in the NP for nominal modifiers, and can head the NP in which they occur). They seem closest to Aikenvald's noun classifier type (although they do not have the predicted anaphoric functions) – this seems to be the first report of such a classifier type in a Papuan language.

Members of the subproject on classification and shape (Bohnenmeyer, Enfield, Faller, Gaby, B. Hellwig, Levinson, O'Connor, Seifart, Senft) have begun to study the contribution of classifiers to the referential semantics of the noun phrase they occur with. It is often claimed that nouns that require

a classifier in order to combine with a numeral are lexically specified as mass (as opposed to count); the classifier is said to individuate the mass noun's denotation, i.e., to act like a mensurative in English (e.g., like ton in three tons of coal). Some doubt is shed on this assumption by the finding that in languages such as Yélf Dnye, the same classifiers that occur with numerals may occur in other contexts as well. Evidence from Miraña (an indigenous language of Colombia, researched by Seifart) and Lao (a South-western Tai language of Laos, studied by Enfield) points specifically to numeral classification as but a special case of a more general use of classifiers in the introduction and tracking of nominal referents in discourse. Shape distinctions appear to play a prominent role in identifying referents for these purposes.

Thus, in Miraña, information about physical shape is mostly encoded in a closed set of about 50 class markers. As in Yélf Dnye, class markers are used to derive denominators for countable concrete objects from semantically general, nonindividuated nouns, e.g., *úhE-ko* (banana-CLASS.long.rigid) 'banana plant'. Unlike in Yélf Dnye, the use of class markers in Miraña is obligatory in virtually all expressions that may introduce or track nominal referents, including numerals, pronouns, relative clauses, etc., and the Miraña system has overall more grammatical importance than the Yélf one. A class marker may be used for agreement marking in pronominal expressions where its choice is determined by an antecedent or head noun associated with a particular "specific class marker" (SCM), such as *kató:-bá* (box-SCM.assembled):

- (2) *te:-ne* *kató:-bá* *íka-néhku [...]*
 PRON-GCM.inan box-SCM.assembled be-SCM.side
- á:-né-7adZú-u* *tsi-7ba* *piko*
 COORD-GCM.inan-top-ADL another-SCM.assembled put.IMP

'this one, the side of the box (ba-class) [...] and on top of that, put another (ba-class)'

The make-up of the system of nominal classification in Miraña allows speakers to use class markers in combination with pronominal stems to not merely track referents, but in fact introduce them, independently of a full noun:

- (3) *é:-i-7hE* *u* *gwáhEnú-du* *tsi-gwa*
 DEM.DIST-SCM.stick-PL 2S.SUBline up-COMP another-SCM.plank
 'like those sticks you lined up, (pick up) another plank-shaped (object)'

In anaphoric pronouns, the use of the ca. 50 shape-encoding specific class markers (SCMs) alternates with that of general class markers (GCMs), which encode animacy and natural gender (see first and fourth word in (2)). There are thus three types of referential expressions that form a hierarchy in terms of their lexical specificity in the sense that a more general expression is in a metonymic relation to a more specific one: (i) full nouns (e.g., *úhE-7o* (banana-SCM.oblong) 'banana fruit'); (ii) pronouns combined with specific class markers (e.g., *te:-7o* (PRON-SCM.oblong) 'that oblong-shaped (object)'); and (iii) pronouns combined with general class markers (e.g., *te:-ne* (PRON-GCM.inan) 'that'). The intermediate category of pronominal elements combined with SCMs can be used to track referents, as can be pronominal elements combined with GCMs, but can also be used to introduce referents, as can full nouns. In reference tracking, pronominal elements with SCMs function, in addition to "activating" accessible discourse referents, as an anaphoric device for disambiguating reference, and to mark discourse boundaries.

Similar phenomena have been studied by Enfield in Lao. Lao has a typologically prototypical numeral classifier system, with dozens of classifiers making fine semantic distinctions of shape or function in the context of enumeration. However, as is the case in Miraña and Yéli Dnye, (a subset of) these classifiers are also used in nominal modification of all kinds, including with demonstratives (in exophoric or discourse deixis and anaphora), attributive modifiers (such as adjectives and relative clauses), and a "unitizing" construction resembling "noun classifier" constructions found in other languages. While the system of classification is almost exactly the same as that found in closely related Thai, many former descriptions of that language concentrated on numeral classifier constructions only, and neglected the uses of the classifiers with other elements carrying nominal referential indices.

Further evidence against the treatment of numeral classifiers on a par with mensuratives, and therefore of classified nouns on a par with mass nouns, comes from Yukatek Maya, studied by Bohmeyer. Numeral classifiers in Yukatek fall into two subsets: there are the three generic classifiers that classify noun referents on the basis of inherent animacy features, and a large set (100-200) of specific classifiers that classify noun referents according to noninherent spatial properties such as temporary shape, orientation, or configuration. In contrast to classifiers in Lao, Miraña, and Yéli Dnye, both types of classifiers occur exclusively with numerals

prefixed to them. However, unlike Southeast-Asian classifier languages such as Lao, Yukatek has strongly grammaticalized plural marking on nouns. Plural marking establishes a formal distinction between mass and count nouns in Yukatek, in that mass nouns either do not pluralize at all or only under "coercion" of an (otherwise unavailable) count noun interpretation (e.g., *semèent-o'b* cement-PL is interpreted as 'bags of cement').

Furthermore, the numeral *hun* 'one' in combination with a classifier is used to mark indefiniteness in Yukatek. Neither plural marking nor this expression of indefiniteness are formally obligatory. Bohnemeyer examined the distribution of plural markers and classifiers in both elicited and unelicited discourses. Preliminary results indicate that the use of these structures is conditioned by the animacy of nominal referents (confirming Lucy 1992), but also by discourse-pragmatic factors such as referentiality. This ties in with Enfield's and Seifart's findings, which likewise point to a role of classifiers in referent maintenance.

Senft undertook a summary of existing knowledge about nominal classification, the types that seem to appear in languages, and how these serve classificatory and other communicative functions. Further work on classifiers has been conducted by B. Hellwig (see section 7.7 below). For research on so-called classifier signs in sign language, see Perniss's contribution in section 7.2 above and Slobin & Hoiting's contribution in Chapter 6.

7.4 Spatial ontology in landscape description

Mark (U. at Buffalo, SUNY) explored with MPI colleagues universals in the ontology underlying geographic or landscape terms. Are mountains, rivers, lakes and the like universally recognized in languages as naturally salient objects to be named? Mark has conducted crosslinguistic elicitation in European languages that suggested strong universal conceptualizations of landscape features. Another question of interest to cognitive geographers is whether geographical entities have well-defined boundaries. Finally, the relation between landscape terms and toponyms (proper names for places) needs to be investigated, since the relation may not be simple.

A number of MPI colleagues have taken up these issues. Levinson explored landscape terminology on Rossel Island, Papua New Guinea, and found there some surprising ways in which landscape features can be segmented. For example, in Yélf Dnye (the language of Rossel Island),

segmented. For example, in Yélí Dnye (the language of Rossel Island), our notion of a river is segmented into three distinctly named parts (see figure 7.6), which are all seen to belong to one (unnamed) semantic field: (1) *mbwaa* (*paa*) 'fresh water (area, side)' names the stretch of a river from main tributaries to the maximum tidal reach, (2) *pye* 'salt water inlet' names the substantial, main stretch of the river from the maximum tidal reach to the river mouth emerging from the mangroves, (3) *kpé* 'flood area of river, where fresh water flows into salt' stretches from the mangroves right out to the (often distant) reef opening, which the flow of every river cuts through the reef. That the three stretches are seen as belonging to one semantic field is shown by the fact that each has a *kn:ââ* 'base' and *nkwodo* 'top', 'canopy' (on analogy to a tree), so what English speakers would call a *river mouth*, for example, is *pye kn:ââ* 'base of salt part of river', as indicated in the diagram. Note that although there is an implicit whole, it does not correspond to the English *river*, since it connects the entire flow of fresh water out to the reef passage. The example shows that landscape ontology does not appear to be universal (Australian English, as used in similar ecologies in e.g., Queensland, does not connect reef passages to rivers).

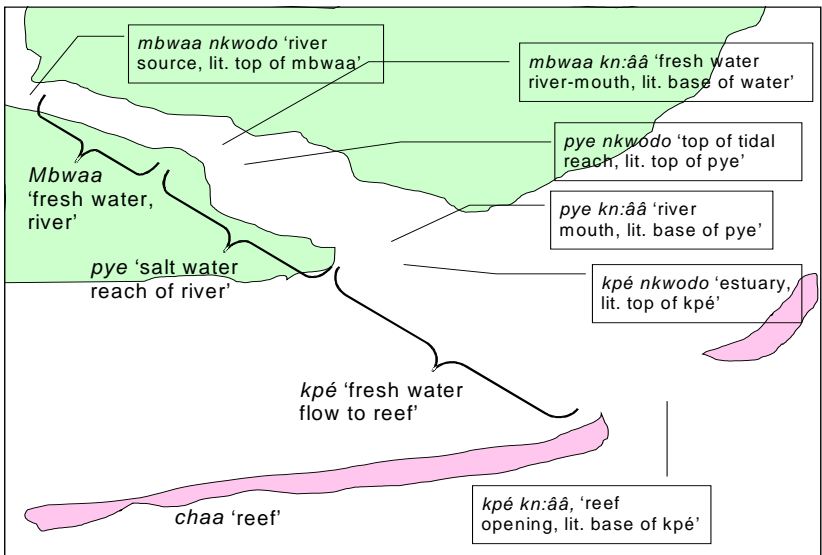


Figure 7.6: The concept of "river" has no exact counterpart in Yélí Dnye, which recognizes three distinct segments of a water course

Burenhult investigated similar questions among the Jahai, a group of hunter-gatherers in the Malay Peninsula speaking a Mon-Khmer language. The Jahai treat the geographical environment linguistically in a systematic manner, with the human body serving as a primary source of metaphors to characterize landscape features (see figure 7.7; cf. also section 7.5 below). Thus, geographical features like rivers, mountains and forests are spoken of in terms of 'bodies' with 'heads', 'arms', 'legs', 'backs', 'chests' and even 'eyes', 'noses' and 'ears'. For example, the 'eye' or 'nose' of a river denotes its source, its 'arms' represent upper tributaries, its 'legs' are lower tributaries, and its 'buttocks' correspond to its mouth; the bottom of a river is its 'chest' and its surface is its 'back'. A river thus appears to be conceptualized as a body lying face-down. Although Jahai has a detailed system of landscape terminology, toponyms label areas that cross cut these features. Judging from origin myths, these place names appear to be conceptually centered at points of water confluence, but the names themselves seldom denote a single, well-defined feature. Rather, a name typically refers to a larger "region" that corresponds to a drainage area and an adjacent massif, and individual features or subparts of such a region are expressed as possessive constructions, e.g., 'X's rivulet' and 'Y's peak'. Interestingly, there are traditionally no names that refer exclusively to inhabited locations. The reason for this is probably to be sought in the mobile existence of the Jahai, whose locations are not inhabited for more than a few days or weeks at a time.

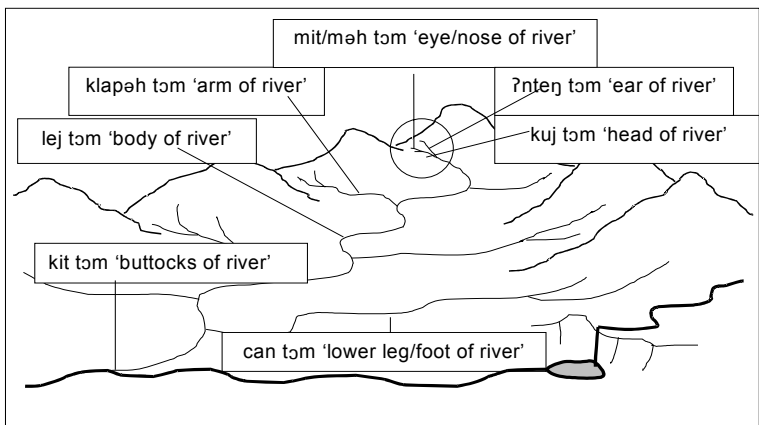


Figure 7.7: Examples of body-part terms used metaphorically to denote features of a river system in Jahai, Peninsular Malaysia

The names themselves are always traced to mythological events and may denote species of plants and animals, tools or other objects, or to the events themselves (then represented by nominalizations of verbs).

7.5 The body as spatial object

The human body is a spatially extended object of special interest to humans, and its treatment as an object with parts is of some interest to the crosscultural study of space. In many (but not all) languages it is a source domain for spatial relators in the intrinsic frame of reference (as in "at the *back* of the church"), and in others the source for relators in the relative frame of reference (as in "to the *left* of the church"). The body, universally similar physically, might be expected to yield simple lexical universals. Earlier work (e.g., by Andersen 1978) suggests considerable variation within universal constraints. Checking and extending those generalizations, work has now begun in the Space Project on the crosscultural segmentation of the body, and the nature of the semantic field, as well as other aspects of body terminology. A number of researchers collected data using a preliminary questionnaire:

RESEARCHER	LANGUAGE
Bohnenmeyer	Yukatek (Mayan, Mexico and Belize)
Burenhult	Jahai (Mon-Khmer, Malaysia)
Enfield	Lao (Southwestern Tai, Laos)
Gaby	Kuuk Thaayorre (Pama-Nyungan, Australia)
Levinson	Yéli Dnye (Isolate, Papua New Guinea)
Meira	Tiriyó (Cariban, North Brazil)
Pyers	American Sign Language (USA)
van Staden	Tidore (Papuan, Eastern Indonesia)

Table 7.1: Languages on which the questionnaire was done

The questionnaire includes some pictures of the human body (as in figures 7.8, 7.11, and 7.12), which could be used in elicitation sessions (e.g., by having consultants color in the body parts that correspond to certain terms, or asking them to place a mark on a body part, given for example that "a mosquito bit his/her arm").

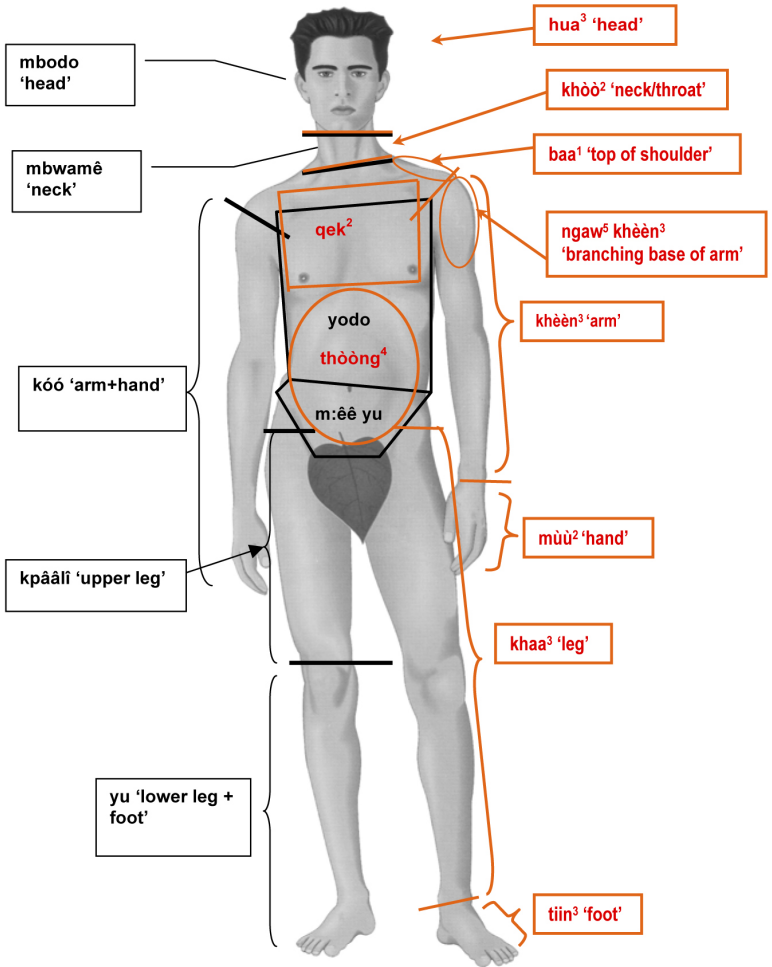


Figure 7.8: Some Yéil Dnye (in black) and Lao (in orange) body part terms compared.

A number of languages revealed unexpected initial segmentations. Yéfi Dnye, for example, has no single lexeme for 'leg', distinguishing instead between *yu* ('lower leg and foot', with no separate term for 'foot') and *kpââlî* ('upper leg'; see figure 7.8 for this and further segmentations). In a more common pattern (shared with e.g., Tzeltal), the term *kóó* for 'arm' includes 'hand', for which there is no separate term. An example from Tiriyo is *wétapi* 'middle' (between chest and abdomen), for which there is no monomorphemic term in English. In Tidore the extension of the label *yohu* glossed as 'leg/foot' does not even coincide with that of *leg* plus *foot*. In fact, as figure 7.9 shows, Tidore *yohu* includes the foot, and all of the lower leg, but only the lower part of the upper leg. Clearly the boundary of the leg is not at the joint, and the ontological status of Tidore *yohu* is unclear. The boundary apparently coincides with the part of the body that must be covered by clothing. The Tidore data suggest that, in categorization of body parts, factors such as taboo areas and dress code and possibly also body decoration and conceptions of beauty must be taken into consideration.

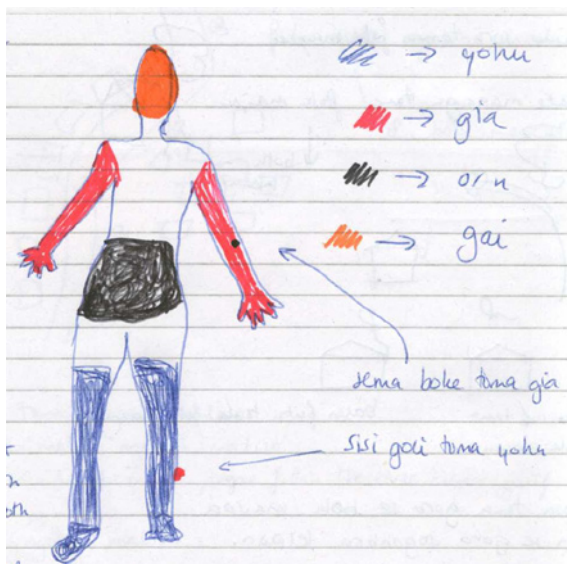


Figure 7.9: Field note showing extension of some body parts in Tidore. Note the extension of *yohu* 'leg', in blue.

These findings underline the need to complement speakers' judgements about the extensional range of the body part terms with descriptive information that helps to determine their intensional semantics. The extensional range of English *shoulder* includes the joint connecting the arm to the torso, as well as areas of the arm and torso on both sides of the joint (i.e., the horizontal part where one would carry something "on one's shoulder", and the vertical part where you might "bump somebody's shoulder"). This would follow from a definition of *shoulder* as "region of body where arm joins torso". Lao, on the other hand, has no word equivalent to *shoulder*, and the extension of English *shoulder* is covered by two words (see figure 7.8): *baa*¹ refers to the horizontal region between the neck and the shoulder joint, and *ngaw*⁵ *khèèn*³ [lit. 'branching base of the arm'] refers to the topmost part of the arm, from the shoulder joint down to the base of the deltoids. Despite these widely varying primary segmentations of the body, there is some indirect evidence that the ontology of parts is not so alien. For example, Yéli Dnye has a special taboo vocabulary used by in-laws, and in this vocabulary there is just one replacement word (*péépi*) for both *yu* ('upper leg') and *kpââlî* ('lower leg+foot'), suggesting an underlying unitary concept "leg+foot". Collocations also suggest that e.g., *yi* is polysemous between 'lower leg+foot' and 'foot' (e.g., *yu kpâpu* 'yu hill' refers to the top of the foot). Nevertheless a placement task (of the kind "If John had a boil on his *yu*, where would it be?") suggests that prototypes for these terms with large extension fall on the middle of the major articulated part (e.g., the prototype locus for 'lower leg+foot' is on the shin, and for 'arm+hand' is on the forearm).

Thus, preliminary crosslinguistic results on the primary linguistic segmentation of the body suggest that existing universal generalizations (e.g., Andersen's) need rethinking.

Body-part terminologies are hierarchical but meronymic (partonymic). In English the *elbow* is part of the *arm* which is part of the *body*. It is necessary in this domain to establish comparable expressions of part-whole relations in each of the languages (*X is a part of Y*). (Previous literature on body parts has not provided details on the crosslinguistic expression of whole-part relations.) There are relevant phenomena in patterns of expression of possession. In Tiriyo, for example, body parts fall into two classes, those that take explicit marking of possessed status and those that do not. In Tidore, many body part terms are inherently possessed, meaning that they are always referred to as belonging to some

superordinate part (e.g., "finger" *gia ma-raga* [lit. 'hand/arm's finger'], "fingernail" *gia ma-raga ma-jum* [lit. 'hand/arm's finger's nail']). Other body parts cannot be readily possessed by a body part at all (e.g., "nose", which cannot be possessed by the head – *dofolo ma-ngun* – but can be possessed by the generic word for 'person': *mansia na-ngun*). If this is taken as evidence for the level in the partonomy at which each body part is represented, then Tidore only has three levels (see 7.10). On the first level are "head", "mouth", "eye", "arm/hand", etc., the second level contains parts of the mouth, eye, ear, arm/hand, and on the lowest level the only body parts are the nails of the fingers and toes.

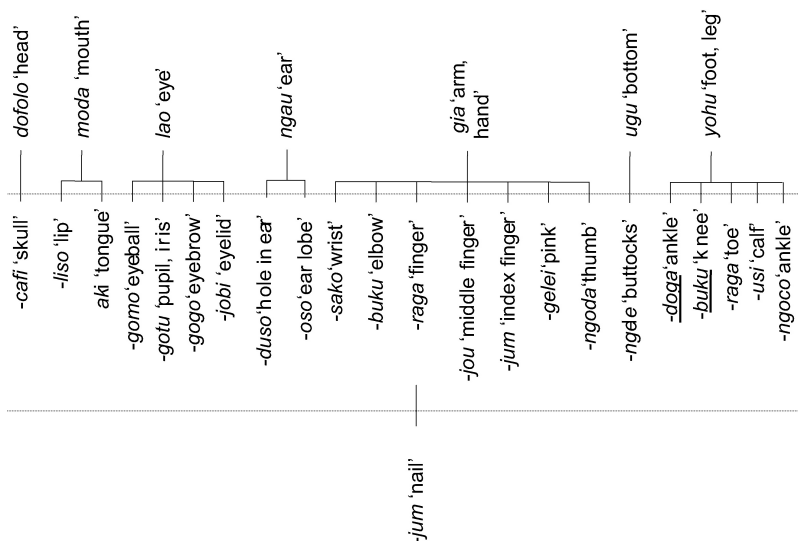
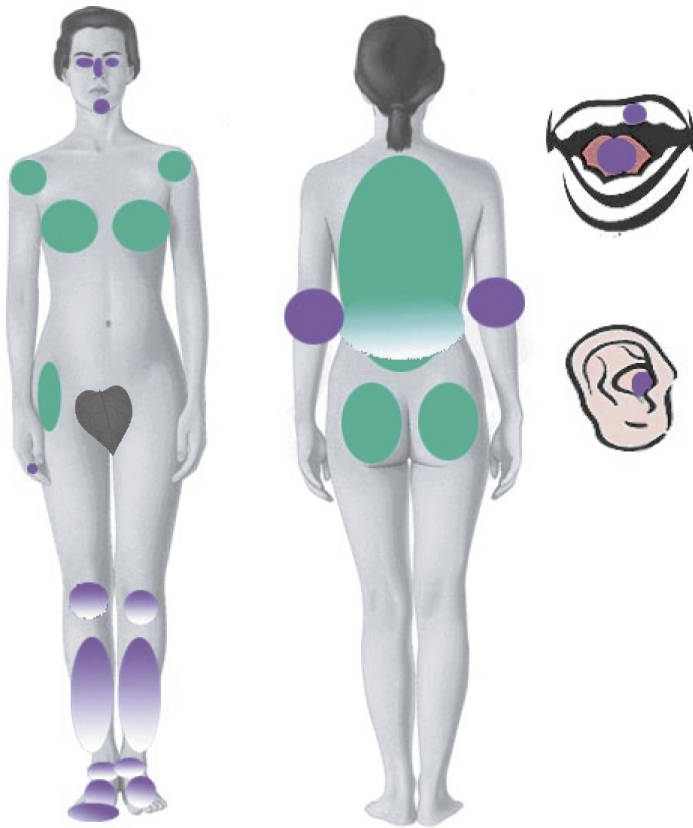


Figure 7.10: Three levels in the classification of Tidore body parts, based on patterns of inherent possession

Van Staden and Majid used an experimental approach to test the comparability of body part terms across languages in a comparative study of Dutch and Japanese (using data collected by Kita). The two questions they addressed were: If two languages both have two labels for, say, the upper limbs – i.e., one for 'arm' and one for 'hand' – do these labels then have the same extensional meanings? If a language has only one term,

how does this one term relate to the two terms in another language? Dutch and Japanese participants were asked to color in body parts according to the labels in their language. The terms were taken from standard dictionaries. Participants' responses were then measured for the uppermost and lowermost points colored in and were compared to assess the extensional meaning of the body part terms. In relation to the first question, both Dutch and Japanese have two labels for the upper limbs, typically glossed as 'arm' and 'hand', but although 'hand' has the same extensional meaning in the two languages, there are significant differences in the extensional meaning of 'arm'. Although speakers of both languages chose equivalent points for the top of the arm (i.e., at the shoulder joint), Dutch speakers consistently used a lower cut-off point where the arm joins the hand. Japanese speakers indicated a cut-off point above the wrist, whereas Dutch speakers chose a point much closer to the wrist joint itself. In relation to the second question, Japanese has one term *ashi* to refer to the part of the body covered by English *leg* plus *foot*. Dutch, like English, has two terms *been* and *voet*. The specific Dutch dictionary label for 'foot' suggests that *ashi* and *been* are not coextensive. This, however, was not confirmed. There was variation within *both* groups of consultants as to whether the foot was included in the extensional meaning of *ashi/been*; hence, no clear difference in the extension of the two terms was attested. This begs the question as to what the exact underlying representation (intension) of the two terms are: are they polysemous, or vague, or is it the case that there is individual variability in the semantics of these terms? This is a question for future research.

Pyers investigated the linguistic representation of the body in American Sign Language (ASL), which differs fundamentally from the other sample languages in that the body itself is co-opted for the linguistic representation of the body. There are three main ways to represent a body part in ASL. First, lexical signs may be used in particular to label socially taboo parts of the body. Second, a range of "indicating" forms may be used, including static points and tracing of body parts, both of which may be articulated using the finger or the whole hand (see figures 7.11 and 7.12). These distinctions suggest an implicit categorization of body parts. Finger points are used for small body parts ("nose", "eye"), distal joints ("elbow", "knuckle") and body parts outside of signing space (e.g., "foot", accompanied by finger spelling).



■ Point with Index Finger ■ Point with Hand ■ Point w/o contact, followed by fingerspelling

Figure 7.11: Use of pointing for body parts in ASL

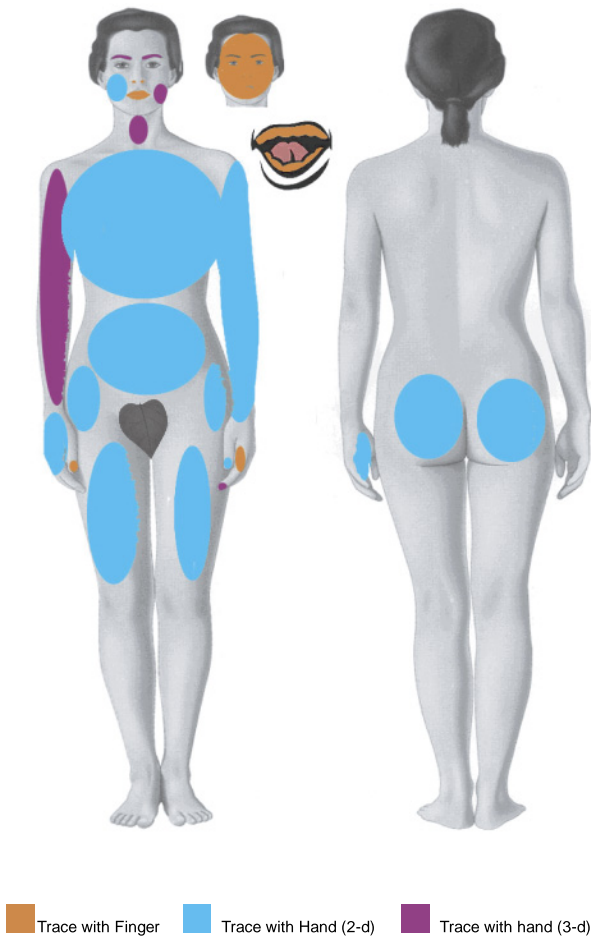


Figure 7.12: Use of tracing for body parts in ASL.

Points using the open hand are used for medium-sized localized body parts ("breast", "neck"), or larger internal organs or "higher" on the limb ("hip", "shoulder"; see figure 7.13). Finger tracing signals are used for small elongated body parts ("finger", "fingernail") and "circular" parts ("face", "mouth"), while tracing signals using the open hand are for body parts with more surface area ("chest") or to specify the surface area of a joint ("shoulder"; see figure 7.14), as well as longer body parts ("arm", "thigh").



Figure 7.13: The sign 'shoulder', articulated with a hand point, refers to the internal joint



Figure 7.14: The sign 'shoulder', articulated with an open palm, refers to the surface area of the shoulder.

Further, some cases involve "3D" hand-tracing, for cylindrical body parts such as "throat" (or "arm" if its 3D nature is being emphasized). Finally, "classifier constructions" (cf. section 7.2 and Chapter 6) are used for representing body parts that are not easily pointed to or traced ("foot", "toe"). In this instance feet and toes are metaphorically mapped onto hands and fingers.

Perniss found that German Sign Language (DGS) provides the same three techniques for representing body parts (lexical signs, indicating signals, classifiers). Differences include DGS making heavier use of "patting" with open hand tracing, use of mouthing for disambiguation, specific hand shapes for internal organs, and pointing to body parts below thighs (e.g., "calf" and "knee").

7.6 Semantic extensions

The Body questionnaire also probed semantic extensions of body-part terms, for example with reference to common artifacts ("neck" of a bottle), natural phenomena ("mouth" of river), and abstract phenomena such as time and space. Gaby examined semantic extensions of Kuuk Thaayorre (Pama-Nyungan, Australia) body-part lexemes to describe other body parts, as well as things not inherently related to the body. For instance, a large number of secondary body-part terms are built from basic body part terms, as in:

- | | | | |
|-----|--------------|---------------|---------------------------------------|
| (4) | paant 'head' | thur 'marrow' | paant thur 'brain' [head marrow] |
| | yuur 'hand' | thip 'liver' | yuur thip 'palm of hand' [hand liver] |
| | pungk 'knee' | paant 'head' | pungk paant 'kneecap' [knee head] |
| | meer 'eye' | pungk 'knee' | meer pungk 'eyebrow' [eye knee] |
| | man 'throat' | kunty 'penis' | man kunty 'uvula' [throat penis] |

The basic body-part terms are also incorporated into a large proportion (probably the majority) of other complex words and expressions. These may be as varied as:

- (5) pam kunyangkar 'brother' (pam 'man', kun 'bum', yangkar 'calf')
 yin thaaw 'door, entrance' (yin 'vagina', thaaw 'mouth')
 raak pungk 'homeland' (raak 'place', pungk 'knee')

Lao shows extensive use of body part terms for parts of inanimate objects (e.g., "ear" of a basket, "eye" of a fishnet, "mouth" of a river), but not all terms have such uses (e.g., *mùŭ*² 'hand', *khèèn*³ 'arm'). Yélfī Dnye shows some reversal of the normal tendency for body parts to be used to name parts of other complex objects (as in *yu kpâpu* 'yu hill', i.e., 'top of foot'). The term for upper arm '*n:uu kn:ââ*' also refers to the wing of a bird, the term for earlobe is *ngwene yââ* 'leaf of the ear', and '*n:uu*' (nose) seems to mean primarily 'point', 'promontory'. Some human parts appear to be derived from the parts for trees: *yi* (lower leg) also means 'tree (trunk)', *kpââlî* (upper leg) 'large branch', *kóó* (arm) 'small branch' (certainly the higher frequency of use of these terms is botanical). Apart from these

contrast, indicate that the speaker cannot assert the actual position (e.g., because it is unknown) and hence has to resort to the semantically general existential.

Gaby is currently investigating the range of postural and motion verbs of Kuuk Thaayorre (Pama Nyungan, Australia), paying particular attention to their employment in locative, existential and copular constructions. She has found that, for any entity, there exists a single verb which is pragmatically unmarked in such constructions (this is typical of locative systems using a small set of postural verbs, see Annual Report 2001: 63). Which verb this is, however, is determined by (often competing) considerations of animacy and prototypical posture/behavior. Typically, the pragmatically unmarked verb for inanimate objects is *wun* 'lie', and all objects positioned on a surface may be described using *wun* regardless of their compatibility with other verbs. So, for example, a bottle standing on a tabletop may be described using *thanan* 'stand' if attention needs to be drawn to its posture, but also as *wun* 'lie' if it is simply its existence/location that is being referred to. In describing humans, however, attention must always be paid to the posture and/or movement of the individual in question. *Wun* is not acceptable unless the protagonist is known or reasonably assumed to be lying:

- (7) *nhul ngaathirr schoolak wun
 3sgS still school-LOC lie:PRES
 'he's still at school'

The unmarked verb for humans is, in most situations, *yan* 'go'. For example, sentence (8a) below is the normal way to describe someone who is in the Post Office (where it is only possible for them to be standing), while sentence (8b) using the "standing" verb is unacceptable unless the speaker can actually see the referent at the time of speech:

- (8a) nhul Post Office-ak yat
 3sgS Post Office-LOC go:PERF
 'he's at (lit. went to) the Post Office'
- (8b) *nhul Post Office-ak thanan
 3sgS Post.Office-LOC stand:PRES
 'he's standing in the Post Office'

That *wun* 'lie' is marked and *yan* 'go' is unmarked for humans, can be seen in the following copular clauses:

- (9a) ngay parr_r mant yantyim
 1sg child:ABS small go:IMPF
 'I was only a small kid'
- (9b) ngay parr_r menmrr yantyim
 1sgS child:ABS baby go:IMPF
 '(when) I was a baby'
- (9c) ngay parr_r mant wun-um
 1sg child:ABS small lie-IMPF
 'I was only a baby'

The use of *wun* in sentence (9c) is marked. Here, the interpretation that he must have been a baby, rather than a child, is solely contributed by the verb of lying.

Animals appear to form a third category in that, like inanimates, they may always be described as *wun* 'lying' regardless of their actual posture. But like humans, they may also be described using the full range of posture verbs (e.g., *nhiinin* 'sit', which may never be applied to an inanimate object).

7.8 The linguistic encoding of motion paths

Previous work in the Project has uncovered variation across languages in the encoding of motion which has been ignored in current theorizing. Thus, Kita (Annual Report 1995) found surprising variation in the semantics of "enter" / "exit" verbs. For example, in Japanese a scenario where an encircling ring slides to enclose a ball could be described as 'the ball entered the ring', suggesting that the semantics of the verb is really defined around the resulting state of enclosure, not the process whereby it came about. Several Project members have now taken up research in this domain, using an improved range of stimuli, Levinson's Moverbs films.

Bohnenmeyer found phenomena in Yukatek similar to those described for Japanese both in the "enter" / "exit" domain and beyond (cf. also Annual Report 1996). Consider the following scenario, in which a slope slides under a ball:

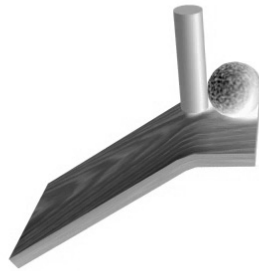
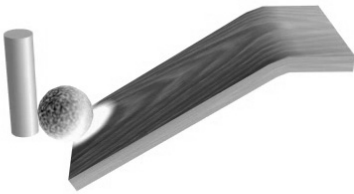


Figure 7.15: First frame of
FIGURE_GROUND 14

Figure 7.16: Last frame of
FIGURE_GROUND 14

Most Yukatek consultants find the description in (10) perfectly acceptable for this scenario:

- (10) Le chan tàabla-o' h péek-nah-ih,
 DET little plank-DEM ASP move-ASP-ABS.3.SG
 káa h na'k le chan kaniika
 and then ASP ascend(ABS.3.SG) DET little marble
 y-éetel che' te'l y-óokol-o'.
 POSS.3-with wood there POSS.3-on-DEM

'The little plank, it moved, and the little marble and the tree ascended there on top.'

Na'k 'ascend' generally carries a conversational implicature to the effect that the Figure moves, which is blocked in (10) by the explicit reference to the slope moving. This is sufficient to license applicability of *na'k* to the ball. Even more consultants accept a resultative form of *na'k* in this case ('the ball has ascended'). Bohnemeyer hypothesizes that the typological trigger for the unacceptability of descriptions such as (10) in English is the grammaticalization of multi-Ground-path constructions with meanings such as 'move from the well to the tree', which entail a homomorphic mapping from the time course of the event into the path connecting the Grounds, and to this extent translational motion. The availability of such constructions may have led to a reanalysis of verbs of location change as entailing translational motion. In Yukatek, multi-Ground-path constructions are unacceptable. However, not all verbs of location change are equally likely to occur in contexts not involving Figure motion. The verbs to the left

of the cline in (11) are most likely to occur in such contexts, while the verbs on the right show no such behavior at all:

- | | | | | | |
|------|-------------|---|---------------|---|----------------|
| (11) | òok 'enter' | | na'k 'ascend' | | bin 'go' |
| | hóok 'exit' | > | em 'descend' | > | tàal 'come' |
| | | | máan 'pass' | | luk' 'leave' |
| | | | | | k'uch 'arrive' |

This is in line with crosslinguistic generalizations that have come from earlier work.

A second phenomenon explored within the subproject on motion path encoding is found crosslinguistically in particular with respect to scenarios of piercing and protrusion, as illustrated in Figure 7.17-7.18:

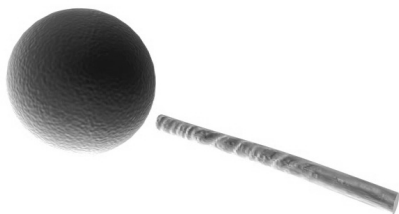


Figure 7.17: First frame of
FIGURE_GROUND 17

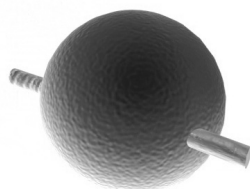


Figure 7.18: Last frame of
FIGURE_GROUND 17

A number of languages, including Japanese and Chontal (a linguistic isolate of Mexico studied by O'Connor), allow locutions such as 'The orange pierces the stick' here, while speakers of Yukatek and Jahai (work by Burenhult) go as far as to admit 'The orange *enters* (*inside*) the stick'. What seems to be happening here is that the criteria for actor pick out the moving object (the orange) as subject of the verb, while the semantics of the verb are sufficiently general to allow this Figure/Ground reversal. The relevant gloss for the "enter" verbs is perhaps something more like 'bring about a containment situation' (for further research on motion, see Chapter 9, Event Representation).

7.9 Space in thinking: The kinship domain

Enfield continued research on kinship as a domain in which nonspatial relations can be given spatial form via externalized representation. One way in which this is done involves cospeech gesture (i.e., the meaningful movements people make with their hands as they speak; see Gesture

Project, section 6.3). Enfield collected video recordings of speakers of Lao (a Southwestern Tai language of Laos) discussing meanings of some Lao kinship terms, and certain restrictions on marriage within the Lao kinship system. Two major observations were made. First, speakers produced external representations of meaning in different modalities – speech and gesture – simultaneously, coordinating them in their efforts to convey meaning in a single conceptual domain. The "diagrams" they constructed were virtual (i.e., "drawn" in thin air), indexed by deictic ("pointing") gestures whose meanings were derived from the verbal commentary. The second observation was that there were consistencies in speakers' spatialization of the Lao kinship domain, relating to a pervasive *high-side/low-side* distinction which stems from a culturally defined importance accorded to relative age among siblings.

This became explicit in discussion of "sibling exchange" (i.e., the possibility of marrying a sibling of one's own sibling's spouse). Figure 7.19 shows two sets of siblings: 1, 2, 3 are three sisters, 4, 5, 6 are three brothers. Relative height represents relative age. Sibling exchange is only possible if both siblings are on the same "side" (upper versus lower in age ranking) of the relevant married sibling. Thus, if 2 and 5 are married (as depicted in figure 7.19), then permissible marriages are 1=4 and 3=6:

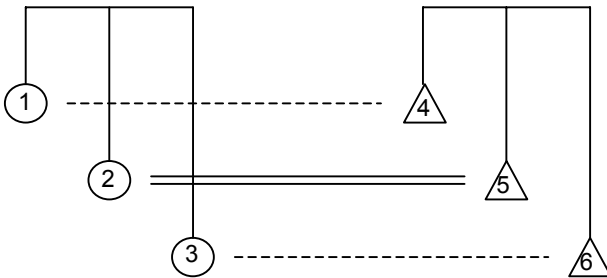


Figure 7.19: Three sisters (1-3, left) and three brothers (4-6, right). The double line means that 2 and 5 are married. The dotted lines mean that permissible "sibling exchanges" are 1=4 and 3=6: it is permitted for two older or two younger siblings of a married couple to wed.

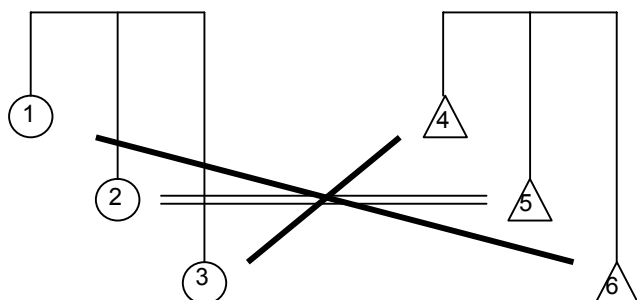


Figure 7.20: The thick lines mean that impermissible "sibling exchanges" are 1=6 and 3=4: it is not permitted for an older and a younger sibling of a married couple to wed.

The following two figures show one speaker's use of cospeech gesture in discussing the impossibility of 1 and 6 marrying (as shown in figure 7.20), using a spatial metaphor of height to represent relative age and laterality to represent different families.



Figure 7.21: "She is of 'high' rank". The speaker (assuming the identity of 5 in Figure 7.20) refers to his wife's older sister (1 in 7.20), as he points high and to his right.



Figure 7.22: "...then (suppose) he comes and marries one of us 'low ones' here." The speaker is now referring to his own younger brother (6 in figure 7.20), as he points low and to his far left.

Figure 7.23 shows another speaker (center) discussing the principle depicted in figure 7.20:



Figure 7.23: "(If two people married as in figure 7.20) it would be crossed, like this."

Further examples reveal consistency within and across Lao speakers in how space is used in representing the domain of kinship. Crucially, no printed diagrams or other artefactual representations were used in these interviews. Work on the topic continues.

8 ISLAND MELANESIA

8.1 Introduction

The Island Melanesia Project is an international, interdisciplinary investigation under the European Science Foundation program "Origin of Man, Language and Languages", involving teams of linguists, archaeologists, biological anthropologists, and geneticists. The linguistic part of the project – the subject of this report – is based at the Institute.

Island Melanesia is defined as an area to the east of mainland Papua New Guinea, including the islands of New Britain, New Ireland, Bougainville, and the Solomons chain (see figure 8.1 at the end of this chapter). The majority of languages in this area belong to the Oceanic branch of the Austronesian family. Throughout Island Melanesia there are also scattered languages that have no demonstrable relationship to the Austronesian languages and that are difficult to relate even to each other. These languages are referred to as the East Papuan languages. It is generally accepted that the East Papuan languages are descendants of languages spoken in Island Melanesia from before the expansion of Austronesian languages into the area, which occurred with the archaeologically attested "Lapita Culture Complex" at least 3,500 before the present (BP). At present, the term "East Papuan" is considered as referring to merely a geographical grouping of languages.

The hypothesis is that these populations speaking relic Papuan languages hold the key to understanding the pre-Austronesian past. There have been few waves of immigration moving through Island Melanesia; after the initial expansion, which reached Island Melanesia 40,000 BP, there is little evidence of other influxes of people until the Lapita expansion. The special

geographic situation of Island Melanesia, both its isolation and its position at the very end of a possible migration route, gives an unusual opportunity to untangle prehistoric layers of settlement.

The project has been running since July 2002, and thus results so far are preliminary. Section 8.2 summarizes the pilot project carried out in 1999-2001 by Dunn, Levinson, Reesink and Terrill. Since the official beginning of the project in July 2002, research in the Nijmegen group has continued to focus on issues of language contact, as well as language description. There are two sorts of contact relevant to gaining a picture of the linguistic prehistory of Island Melanesia. Firstly, it is hypothesized that there was contact between the ancestors of the current East Papuan languages. This contact is most likely indistinguishable from genetic relatedness at this great separation in time. Secondly, as all the Papuan languages are now in contact with Oceanic languages to a greater or lesser extent, it is important to be able to recognize similarities originating from contact, with these languages. In sections 8.3 and 8.4 respectively, Terrill and Levinson report on studies isolating Oceanic contact, in particular East Papuan languages, and in section 8.5 B. Evans and Terrill report on Papuan influence on Oceanic languages.

Linguistic survey and descriptive work is also an important part of this project, since the Papuan languages of Island Melanesia are not very well known. In section 8.6 Reesink reports on survey work in New Britain and Bougainville. In sections 8.7, 8.8 and 8.9 respectively, three other East Papuan languages are discussed: Dunn reports on Touo, Wegener on Savosavo, and Lindström on Kuot.

The project web page was constructed by Lindström and is published at www.eastpapuan.ling.su.se.

8.2 Pilot project: Internal relationships between Papuan languages of Island Melanesia

The motivating issue of the pilot phase of this project was the nature of the relationships between the Papuan languages of Island Melanesia. In the past it has been assumed that these languages are genetically related as one family, but this has never been thoroughly put to the test. The pilot project aimed to discover whether they share typological similarities that would enable them to be viewed as an areal grouping. The results of the pilot project were published in two papers. The first paper (Dunn, Reesink

and Terrill 2002) looked at the typological similarities and differences between these languages, and found that some typological similarities support Ross's (2000) proposed genetic families, which were based only on pronominal evidence. The second paper (Terrill 2002) examined the nominal classification systems of Island Melanesia. These have long been thought of as one of the defining features of the Papuan languages of the islands off the east coast of New Guinea. However, while almost all of these languages do have nominal classification systems, they are, in fact, extremely divergent from each other, and betray little evidence of relationship between the East Papuan languages as a group.

8.3 Lexical borrowing between Lavukaleve and Oceanic languages

Terrill conducted a study to examine the extent to which linguistic borrowing can be used to shed light on the existence and nature of cultural contact between Papuan and Oceanic speakers during the last 3,500 or so years since Oceanic speakers first arrived in Island Melanesia. The question was addressed by taking one Papuan language, Lavukaleve, spoken in the Russell Islands (Solomon Islands), and examining lexical borrowings between it and nearby Oceanic languages, as well as Proto-Oceanic as a whole. A corpus of 1,700 Lavukaleve words was compared with reconstructed Proto-Oceanic forms as well as the lexica of two synchronic languages, one from each of the two major Oceanic subgroups represented in the Solomon Islands today. The resulting data set was analyzed in two ways. By looking at the sound changes that have occurred in words shared between Lavukaleve and the Oceanic languages it is possible to identify the direction of borrowing, to identify the specific source of the loan, and to identify the relative age of the loan. Secondly, examining the semantic nature of the words borrowed enables an understanding of the nature of the cultural contact that has been taking place.

The results of the study suggest, firstly, that the nearby Oceanic languages and Lavukaleve have mostly been *in situ* for a long time and that the current language map of at least this area of the Solomon Islands represents more or less the way it has been for some time. There is linguistic evidence of sharing of cultural knowledge and material culture, in particular seafaring terminology, and to a lesser extent garden terminology and cooking and household terms. It is also significant that there has been

a certain amount of sharing of basic vocabulary, e.g., body-part terms and basic geographical terms. In this respect, Thomason (2001), following from Thomason and Kaufman (1988) shows that the first words to be borrowed in a contact situation are words referring to new items or ways of doing things. For further words to be borrowed points to somewhat of a deeper level of cultural contact, beyond the most superficial.

The emerging picture in this region is one of slight contact, which involved cultural and technological exchange, but did not result in widespread bilingualism, and probably did not involve a great amount of intermarriage relations. This finding has major implications for biology/population genetics. It is envisaged that these linguistic results will be correlated with emerging results of the genetics and biological anthropological teams also working on this project, in order to flesh out our knowledge of prehistoric Island Melanesia.

8.4 Austronesian loans in Yélf Dnye, Rossel Island

Levinson has continued his fieldwork on Yélf Dnye, a Papuan language spoken at the easternmost extremity of the Louisiade Archipelago. Yélf Dnye is clearly unrelated to the surrounding Austronesian languages – Henderson (1975), on the basis of vocabulary lists, reports only 6% cognates with the neighboring Austronesian language on Sudest, and only 3% with Misima, 100 nautical miles away. Nevertheless, now that the first published report on the Sudest language has appeared (Andersen & Ross 2002), some elements of convergence with Sudest can be seen, almost certainly reflecting assimilation of Sudest to its Papuan neighbor, or perhaps to a related language once spoken on Sudest. Sudest boasts 36 consonantal phonemes, very unusual for an Oceanic language, including prenasalized and labialized series as on Rossel (with its 56 consonants). The languages share verbal inflection by pre- and postverbal clitics. There are many other detailed similarities (e.g., classifiers, tense/aspect, deictic discriminations, and a number of obvious cognates). Nevertheless at base the languages are radically different: Sudest is SVO with fixed word order, nonergative, has inclusive/exclusive pronouns, and many other typical features of Oceanic languages, while Yélf Dnye is loosely SOV, ergative in morphology and syntax, postpositional, and without inclusive/exclusive distinctions in the pronouns. Still, the amount of non-Oceanic structural features in Sudest suggests that a Papuan language like Yélf Dnye was once spoken on Sudest.

A number of early Oceanic loans can be detected in Yélfí Dnye, that is, forms cognate with Proto-Oceanic rather than with the current surrounding languages. These have considerable interest for understanding prehistoric connections. They include the number words, words for technological imports like the sail, pottery and the like (see Ross, Pawley and Osmond 1998). Examples include *ndipi* 'lid' (< Proto-Oceanic **tupi* 'lid, cover'); *pala* 'woven coconut mat' (< Proto-Eastern-Oceanic **bola* 'coconut leaves woven together for any purpose, including mats'); *lyé* 'sail' (< Proto-Malayo-Polynesian **layaR*, North New Guinea *lai* – Papua Tip *lara/naia*, etc.); *podo nee* 'chief's racing canoe (without sail)' (< Proto-Western-Malayo-Polynesian **padaw* 'kind of sailboat'). The fact that the forms appear to be borrowed from Proto-Oceanic rather than a present-day Oceanic language suggests, among other things, that the loans must be very old. Given that current thinking is that the homeland of Proto-Oceanic was New Britain, this also gives rise to interesting questions about early movements of Proto-Oceanic-speaking people.

8.5 Oceanic-Papuan contact

B. Evans (Australian National U.) visited the Island Melanesia Project during December 2002. Since all the East Papuan languages are in contact with Oceanic languages more than they are in contact with each other, it is important to be able to distinguish recent contact-induced change from possible genetic relatedness.

The Oceanic languages of Island Melanesia are characterized by unusual internal diversity, as well as a high degree of difference from other Oceanic groups, sharing a number of innovative features that appear to be similar to features of the East Papuan languages. This has often been attributed to contact between Oceanic speakers and speakers of Papuan languages. However, no detailed study with respect to contact has been carried out.

Terrill and B. Evans have begun research into one structural feature that appears to be shared by the Oceanic languages of New Georgia and Santa Isabel and at least one Papuan language: Lavukaleve of the Russell Islands. The Oceanic languages have developed clause-final topicalization constructions where the topic is marked by *si*, as can be seen in examples (1) and (2) from Maringe and Kokota, respectively. The unmarked clause order in these languages is VSO.

- (1) me mei ke ulu-ña naʔa si kaisei mogo ia
 and come PREP front-3sg 3sg TOPIC one snake ART
 '...and there was a snake coming towards him.' (Ross 1988:240)
- (2) o-ti dupa-i manei si-ago
 2sgS-NEG punch-3sgO he FOC-2sg
 'Don't you hit him!' (Palmer 1999:238)

The study aims to discover whether this unusual topicalization strategy can be related to a structure in Lavukaleve, in which focused constituents are marked by a clause-final focus marker based on the stem *fi* (3sg neuter focus marker).

8.6 Linguistic survey of northern Bougainville and New Britain

One major focus of the Project is description of the Papuan languages in Island Melanesia. In particular, data is lacking for the languages of northern Bougainville and New Britain. Reesink undertook a field trip to survey the hitherto undescribed or underdescribed Papuan languages on New Britain and northern Bougainville, with a view to obtaining materials to do sketch grammars of some, and obtaining permission and contacts for long-term fieldwork for others.

Reesink collected lexical and grammatical materials on Kol, spoken on the central mountain ranges of east New Britain, as well as on Sulka, the language of Wide Bay, New Britain. Reesink also obtained approval from the Bougainville Interim Government for a member of the project to work on one of the northern Bougainville languages, either Konua, Rotokas, Eivo, Keriaka, or Torokina. It is planned that Robinson, a Ph.D. student, will work on one of these languages. While on Bougainville Reesink also visited a Konua village in order to collect Konua materials, with a view to conducting long-term fieldwork there.

Reesink has also initiated a study of historical comparison of noun-formation strategies in various of the East Papuan languages. He examined plural-formation strategies in four languages, Kol (New Britain), Sulka (New Britain), Kuot (New Ireland) and Lavukaleve (Solomon Islands). In each of these languages, plurals are formed from morphological affixation of the singular-noun form, and serve to divide nouns into a number of declensions. Plural forms are highly irregular and it is well known that irregular morphology is likely to be of some age, and is there-

fore a good candidate for identifying ancient relationships between languages. In particular there is a possible relationship between the ubiquitous plural morpheme *-v* in Lavukaleve, the common plural marker *-p* in Kuot, and one of the plural morphemes in Kol, *-be*.

8.7 Linguistic categories in Touo (Baniata) and SIP

Dunn investigated frames of reference and the grammatical category of number in Touo with a view to designing psycholinguistic experiments for the 2003 field season, as well as to investigate mechanisms of structural borrowing into Solomon Island Pijin (SIP), the near-universal second language of the area. SIP is a creole language with a small community of native speakers located mostly in the capital city, Honiara. On the island where Touo is spoken and the neighboring islands, SIP is mostly spoken as a second language.

Touo has four number categories, reported in the previous literature (e.g., Todd 1975) as Singular, Dual, Trial and Plural. Field investigation has shown that while the singular and dual operate as expected, the so-called "trial" and "plural" indicate determinate and indeterminate plurals respectively. The determinate plural is used in a noun phrase with any numeral of 3 or more. It is also used in contexts where quantity could feasibly be enumerated, such as referring to the people in a crowded room. The indeterminate plural is used where the quantity could not be feasibly enumerated, for example referring to a hypothetical group of objects. It is also used spontaneously in reference to the people of a village (a large spatial distribution of people continuously coming and going). It is hypothesized that Touo speakers habitually attend to the determinacy of plural groups, whereas speakers of languages without such a system do not attend to this. This hypothesis is testable to the extent that attention to the determinacy of plural groups will have observable linguistic and nonlinguistic effects in comparison with other languages.

In the variety of SIP spoken by native Touo speakers, speakers regularly make extra-number specifications, with forms such as *iumitrifala* '1st person trial inclusive' (i.e. to refer to speaker, addressee and one other), whereas in similar situations in the Russells (Lavukaleve speakers) or Honiara (mostly speakers of Malaitan Oceanic languages) the SIP form *iumi* '1st plural inclusive' would be used. The form used by Touo speakers is regularly formed according to available morphological resources of SIP.

This is an example of structural interference from Touo upon SIP in bilingual speakers. A markedly different situation obtains with the Touo absolute frame of spatial-reference system. In Touo, spatial reference is made using an absolute system with axes indicating "inland-seawards" and "clockwise-counterclockwise", all determined from an imaginary center point of the island. These directions are all referred to using monomorphemic terms, and these terms are ubiquitous in speech. Most of the other languages of the region also have absolute frames of reference, but the usual axes are "inland-seawards" and something roughly corresponding to "east-west". There is no problem expressing the notions relating to inland and seawards in SIP, and Touo speakers indeed do so in SIP with a similar functional range as in their native Touo. However, there is no obvious way to adapt the clockwise-counterclockwise axis using SIP linguistic structures, and in SIP spatial description by Touo speakers an axis orthogonal to the inland-seawards axis seems simply to be absent.

8.8 Participant marking and serial verbs in Savosavo

Wegener, a Ph.D. student, started research on Savosavo, the language of Savo Island, one of the four Papuan languages spoken in the Solomon Islands. There is little material on Savosavo. Codrington (1885) gives a sketch grammar and Todd (1975) talks about some parts of the grammar comparing the Solomons Papuan languages in order to find out how they are related.

One of the most interesting parts of the grammar of Savosavo is the verb, especially with respect to participant marking and serial-verb constructions. One participant marking feature in Savosavo frequently found in the languages of that area consists in alternating object-marking patterns (cf. Dunn, Reesink and Terrill 2002), meaning that objects are marked either by a prefix, a suffix, or both. While object marking is obligatory in Savosavo, the subject is not marked on the verb. This is uncommon in Papuan languages, but quite frequent in Austronesian languages and is likely to be the result of centuries of contact.

Serial-verb constructions in Savosavo are used for a wide range of grammatical functions, e.g., resultative, manner, benefactive, allative, and completive aspect. Furthermore they are also used for different kinds of lexical event encoding: They link macroevents and by this means compose larger event complexes ("narrative serialization", cf. Annual

Report 2001: 87), but also compose macroevents by linking subevents ("component serialization", cf. Annual Report 2001: 87).

8.9 Historical reconstruction of Kuot

Lindström (U. Stockholm) has been using internal reconstruction of Kuot to investigate the source of certain typological features of the language in order to generate hypotheses about past linguistic contact. While modern Kuot (Lindström 2002) has VSO constituent order, the verbal morphology suggests that SVO order was dominant at some point in the past. The phonemes /s/ and /f/ are comparatively recent additions to the language, originating in Oceanic contact. Different verb classes involve different constituent orders. The absence of the phonemes /s/ and /f/ in the one verb class that retains SVO ordering (class II), shows that this SVO order predates contact with Oceanic languages. The SVO order may or may not have been contemporaneous with a third-person predicate-subject order for statives (now analyzed as adjectives). The 100+ stems of class II are therefore of particular interest for lexical comparison with verbs in other non-Oceanic languages in the region, both because they are clearly old, and because possible influence from Oceanic contact can be ruled out. Several factors point to a subsequent stage of OV syntax for both pronominal and nominal objects; among these are the morphological structure of verb classes I and III, object prefixes, and possessives.

Internal reconstruction of nominal morphology is similarly revealing. Dual marking on the majority of nouns appears to be an innovation in that it is added onto plural marking, but kinship terminology tells a different story. Here, as in the pronominal system, dual marking is in a paradigmatic relation to plural marking, and further distinguishes masculine and feminine gender. This suggests that dual on nouns is, at least partly, a well-integrated category in the language. This is highly significant, as one of the distinguishing features of Oceanic languages in the region is their development of a dual category. If it can be shown that the dual category is ancient in Kuot, and indeed in other East Papuan languages, then this is a possible source for the Oceanic dual category.

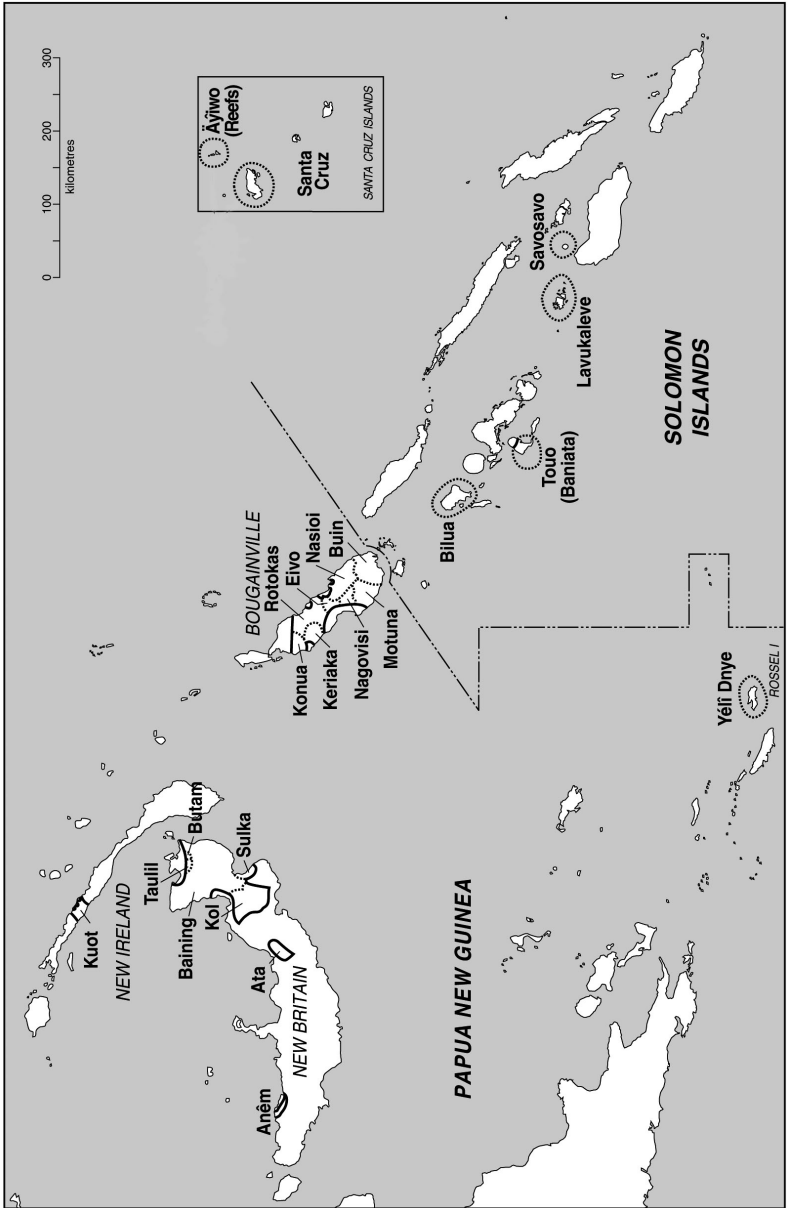


Figure 8.1: Island Melanesia.

9 EVENT REPRESENTATION

9.1 Introduction

This project focuses on the crosslinguistic study of the coding of events and their participants, and how children acquire these structures. Languages represent events as having an internal structure composed of a set of participants and the roles they play in the event, such as the initiator of the event or an entity that undergoes a change of state or location. Project members investigate language-particular and universal constraints on event representation – e.g., how speakers of various languages characteristically parse an ongoing stream of experience into simple or complex event units, how they assign participant roles to the events that have been singled out, and how they mark these roles and map participants onto syntactic clause structure. They also explore children's acquisition of event representation patterns in the language they are learning, including how they tune in on pervasive patterns of event construal, determine the meanings of event predicates, and master the morphological and syntactic treatment of event participants.

In 2002, work continued on issues concerning argument structure, argument marking, and complex verbs, often focusing on the semantic domains of motion (joint research with the Space Project, see Chapter 7) and causal relations among events. A new element this year is work on comprehension – e.g., how linguistic cues influence people's inferences about causation. Among other sources of data, project members have made extensive use of data gathered in a wide range of field sites with structured elicitation tools designed by group members to allow close comparisons across languages. The stimuli consist of sets of videotaped

"events" for speakers to describe; this year's research made use of data collected with ECOM ('Event COMplexity', Annual Reports 1999 and 2000), Staged Events (Annual Report 2001), and Tomato Man (Annual Report 2001 under Gesture, Chapter 5), and a newly developed stimulus set, Cut and Break. In the following report, studies focusing on argument structure issues are presented first, followed by studies on event construal and event encoding.

9.2 Argument structure

9.2.1 Participant marking

In developing her feature-based approach to language acquisition (Annual Report 2001), Eisenbeiß focused on the development of the morphological paradigms used to mark arguments encoding event participants. An analysis of longitudinal corpora from seven children learning German (age range: 1;11–3;6 years) provides evidence for a stepwise construction process in which the acquisition of number, gender, and case distinctions interact. The first distinction to appear is number ([± PLURAL]). This is followed by [± FEMININE], which distinguishes feminine from masculine and neuter nouns. Next comes [± MASCULINE], which differentiates masculine and neuter nouns; this feature emerges together with the contrast between nominative and accusative case. Last to appear is dative case.

Eisenbeiß interprets this acquisition order as follows. Gender in German is acquired not by bootstrapping from natural gender, but as a set of formal features motivated by the child's attempt to distinguish between multiple distinct forms that all share the same feature(s) in an as-yet under-differentiated morphological paradigm based on number. For example, once the opposition between singular and plural has been established for definite articles, learners find that three forms – *der*, *die*, *das* – compete for the [– PLURAL] paradigm "cell". On observing that nouns ending in schwa (i.e., a subset of feminine nouns) selectively combine with only one of these forms (*die*), children contrast these nouns with the others by setting up the feature [± FEMININE]. The other two forms (*der* and *das*) cannot be distinguished through any consistent phonological or semantic groupings of the nouns they collocate with. To differentiate them systematically, the learner must compare noun phrases in different syntactic environments: one group of noun phrases exhibits a nominative/accusative contrast (*der* vs. *den* – masculine nouns), while the other does not (*das* in both contexts

– neuter nouns). The child now sets up the feature [\pm MASCULINE], which distinguishes nouns of the two types and restricts the nominative-accusative contrast to the masculine set. Dative forms appear even later, a noteworthy delay since there are more dative than accusative markers in the input (many prepositions and verbs govern dative case). This suggests that dative case is acquired not as a property associated with specific lexical items, but through analysis of indirect object markers in constructions with three-place predicates. Dative case is delayed, relative to nominative and accusative case, because there is less relevant data: information about dative is restricted to constructions with three-place predicates, whereas information about nominative and accusative is found in constructions with both two- and three-place predicates.

In another study of participant marking, P. Brown, in collaboration with Pye (U. Kansas), de León (CIESAS, Mexico), and Pfeiler (Autonomous U. of Yucatan, Mexico), compared the development of verbal inflection in four Mayan languages: K'iche', Tzeltal, Tzotzil, and Yukatek. These languages have broadly similar marking patterns; e.g., they have a generally agglutinative morphology and transitive verbs carry separate cross-referencing inflections (argument markers) for the two core arguments (called "ergative" and "absolutive" here); verbs are also inflected for aspect and mood, and carry an additional "status suffix" which generally marks verb transitivity and mood. A morphological template for the verbal complex (ordered as in Tzeltal) is shown in (1):

- (1) Mayan verb template: Aspect + (Ergative) + Verb_Stem + Status + Absolutive + (Plural)

At a more detailed level, the four languages differ strikingly in the realization of crossreference marking. For example, in Tzeltal and Yukatek the absolutive markers are always suffixes (as shown in (1)), whereas in K'iche' they are always prefixes; in Tzotzil some are prefixes and some are suffixes, depending on aspect and person. The marking of the single argument of an intransitive verb also differs: K'iche', Tzeltal, and Tzotzil use the absolutive for this function, whereas Yukatek splits on the basis of aspect (absolutive for perfective verbs and ergative for imperfective verbs).

For each language, longitudinal acquisition data were examined from two children at around 2;0, 2;6, 3;0, and 3;6 years of age. In general, crossreference marking is productive in Mayan children by 3;0 to 3;6; with

aspect marking becoming fully productive only later. But acquisition patterns differ across the languages. For example, absolutive marking emerges earlier when it is expressed by suffixes than when it is encoded by prefixes. Prosody and phonological structure also play an important role, explaining, for example, why K'iche' and Yukatek children's first words consist of the stressed end of the phonological phrase, whereas Tzeltal and Tzotzil children strip off affixes and produce bare verb roots. The children showed no preference for crossreferencing notional subjects over notional objects (as might be expected if subjecthood is salient enough to children to override the distinction in morphologically ergative languages between transitive and intransitive subjects). Ergative marking with transitive verbs was acquired at about the same rate as absolutive marking with transitive and intransitive verbs. Learners of Yukatek showed no difficulty in acquiring that language's form of split ergativity. Most striking was children's early acquisition of status suffixes – in all four languages, these emerged well in advance of aspect and crossreference marking. Errors are mostly of omission, with very rare cases of double marking or overgeneralization in crossreference marking (confusion of ergative and absolutive inflections, of subject and object agreement, and of person marking).

A long-standing concern of project members has been to document and compare variation in conditions of argument marking and argument realization across languages, in part as a prerequisite to investigating learnability claims about language acquisition. Sakel investigated participant marking in Mosestén (Mosestenan, Lowland Bolivia). In this language it is often hard to determine the syntactic role of an argument on strictly formal grounds. There is no ergative or accusative marking for core arguments, i.e., nominals expressing subjects, primary objects, and secondary objects are always unmarked. Word order is usually subject-verb-object, but the object can precede the subject in pragmatically marked environments. Thus, often the only good indicator of the role of an argument is the crossreference marker on the verb. This marker jointly crossreferences at most two arguments – the subject and the primary object (the object of a transitive verb, or e.g., the recipient of a ditransitive verb). Intransitive verbs inflect almost exclusively for the gender of the subject. With transitive verbs, the crossreference markers can refer to the person, number, and gender of the subject and object, although all forms involve only a subset of these features. Ditransitive verbs have a secondary object encoding e.g., a transferred entity; this argument is not

crossreferenced on the verb, and usually stands unmarked in the clause. Usually it is clear from the context which object is primary and which secondary; a difference in the animacy of the two nominals can also provide a clue (an animate nominal will usually be the primary object).

9.2.2 Argument structure and clause structure

The grammatical relations of arguments in clauses – as marked e.g., by cases – have syntactic reflexes in many languages. As part of the ongoing Island Melanesia Project (see Chapter 8), Levinson has observed a new systematic kind of syntactic ergativity in Yélî Dnye, the Papuan language of Rossel Island, Papua New Guinea. Ergativity involves (in Dixon's terminology) the grouping of transitive objects (in O-function) with intransitive subjects (in S-function):

(2) The man (A) hit the pig (O).

(3) The pig (S) ran away.

In familiar European languages S and A are marked with the nominative case, and O with the accusative. In many other languages S and O share absolutive case marking, while A is marked with a distinctive ergative case. Yélî Dnye, along with perhaps a quarter of the world's languages, is of this kind. Much more rarely (in perhaps 2% of languages with ergative case marking), the grouping of S and O is fundamental to syntax as well as morphology. In the classic Australian cases like Dyirbal, this grouping is crucial to interclausal syntax – e.g., one can conjoin two sentences while omitting the S-argument of the second sentence only if it is coreferential with the O of the first ('the man_i hit the pig_j and \emptyset _j ran away').

Yélî Dnye turns out to have a different kind of syntactic ergativity. Interclausal relations are unconstrained – relativization and conjunction with gapping do not depend on the function (A, S, or O) of the relativized or elided argument. But intraclausal syntax is either similarly unconstrained (e.g., Wh-questioning of NP in any role) or operations apply only to S or O, or only to A (and not only to A and S). Operations sensitive to the absolutive grouping (S+O) include a focus operation, quantifier floating, and nominalization. For example, (4) and (5) show how the same construction with *vyîlo* is used to focus both S and O (the focused NP is underlined); (6) shows how a separate construction with *yinë* is used to focus A:

- (4) *Kí* *dmââdî* mbwódo vyílo yi kmaapî. ←vyílo highlights S
 that girl on.ground FOCUS-ABS 3S.FOC dine
 'This is the girl (S) who was eating (intrans.) on the ground.'
- (5) *Kí* pini ngê *chêêpî* vyílo yi d:ii. ←vyílo highlights O
 that man ERG stone FOCUS-ABS 3S.FOC threw
 'That's the stone (O) that the man threw.'
- (6) *Kí* *pini* ngê *chêêpî* yinê dè d:ii. ←yinê highlights A
 That man ERG stone FOCUS-ERG 3S.IMMEDPAST threw
 'That's the man (A) who threw the stone.'

This appears to be a distinctive kind of syntactic ergativity, different from the Australian cases and closer perhaps to those reported for many Mayan languages (e.g., Larsen & Norman 1979). In Mayan, focus constructions similar to those at issue here likewise display ergative syntax. However, while at least some of these Mayan constructions (e.g., Bohnemeyer 2002) are clefts, i.e., biclausal constructions (just like the English translations of (4) – (6)), the structures in (4) – (6) are monoclausal. The typology of ergative syntax may thus be broader than has been thought, varying from the interclausal kind in Dyirbal to the intraclausal kind in Yélf Dnye, with the Mayan cases perhaps intermediate in kind.

As part of her Ph.D. research, Lüpke investigated a formal split among intransitive verbs in Jalonke (Western Mande, Guinea). When an intransitive verb is nominalized, its single argument appears as the possessor of the situation expressed by the verb (comparable to *John* in *John's singing*). This possessor is presented in one of two ways: For some verbs it appears in the *inalienable* possessive construction (IPC), while for others it occurs in the *alienable* possessive construction (APC). Although the split between intransitives that take the IPC vs. the APC is no longer fully motivated synchronically, two facts, taken together, suggest that it can be explained diachronically in terms of unaccusativity. First, the intransitives that take inalienable possessors (IPC) are all either inherently intransitive state-change verbs or causative/inchoative alternating state-change verbs (although some members of these classes take alienable possessors, as do all other intransitive verbs). Verbs of these classes are typically unaccusative in the world's languages; i.e., their single argument behaves like an underlying object. Second, there is an explicit association between objecthood and the IPC in nominalization patterns for *transitive* verbs in Jalonke: when the possessor is expressed in the IPC, it is under-

stood as playing the object role (comparable to John as the punished participant in *John's punishment*), and when it is expressed in the APC, it is understood as the subject (John as the punisher). The association between IPC and objecthood in fact runs deep in Mande languages: the synchronic pattern for combining verbs with objects arose diachronically from a nominalized verb with an inalienable possessor, comparable to e.g., *I am at the rice's eating* 'I am eating rice'. The first extension of the IPC from transitive to intransitive verbs probably involved alternating causative/inchoative state-change verbs, since this would have allowed a consistent syntactic treatment of the theme argument regardless of whether it was the object (in a transitive clause) or the subject (intransitive clause). Later the IPC was extended to inherently intransitive state-change verbs as well. In the nominal domain, the IPC denotes inherent relations. The treatment of the themes of state change verbs as inalienable possessors may have been motivated by the construal of the theme of a state-change verb as more inherent to its meaning than its external cause is.

9.2.3 Predicate semantics and participant structure

As part of ongoing work towards a general survey of Lao grammar, Enfield analyzed Lao word classes, focusing on the verb class. Adjectives are a subclass of verbs in Lao. Of special interest are the argument structure properties of this class. Adjectives typically take a single nominal argument, but there are at least four different constructions in which adjectival verbs can take two direct nominal complements in Lao. First, in the external possessor construction, the subject argument is semantically a possessor of the object argument (often a body part), and the object argument is usually a locus of some experience. For example, the adjectival verb *mùaj1* 'tired' usually takes a single experiencer argument, but it can also have an added possessed locus of experience, as in *khaa3* 'leg' in the following:

- (7) Khòòj5 mùaj1 khaa3.
 1SG tired leg
 'I'm tired (in the) legs.'

Second, in the experiencer-subject construction, the subject participant has an experience due to the stimulus expressed by the object. For example, the adjectival verb *sèèp4* 'delicious' usually takes a theme subject, but in a two-place construction the theme argument is expressed

as the object and an experiencer (*khòj5* 'I' in the following example) is put in the subject position:

- (8) *khòj5* *sèèp4* *qahaan3* *nii4*.
 1SG delicious food this
 'I (find) this food delicious.'

Third, in the caused-state construction, the subject participant causes the object participant to come into the state predicated by the adjectival verb. For example, *dam3* 'black' usually takes a single-theme argument, but in this two-place construction, the theme argument is in object position, and a causer is expressed in subject position:

- (9) *Khan2-cap2* *nii4* *dam3* *mùù2*.
 handle this black hand
 'This handle blackens (your) hands.'

Last, the applied-effector construction adds an argument which is the cause of the state denoted by the adjectival verb. For example, *vaan3* 'sweet' normally takes a single-theme argument, but in this construction something responsible for that state is added in object position:

- (10) *Kèèng3* *vaan3* *qòj4*.
 soup sweet sugar cane
 '(The) soup (is) sweet (from the) sugar cane.'

As these examples show, adjectival verbs in Lao can appear in a range of two-argument constructions, defined by different configurations of the thematic roles of the arguments and their syntactic positioning. This raises interesting issues for the predictability of argument structure from predicate semantics. While adjectives are normally expected to select a single core participant, in this case a range of alternations involving two-participant frames is found. Further research will pursue whether these alternations can be dealt with by (a) setting up subclasses of adjectival verbs according to the range of frames they project, or (b) formalizing a set of semantically specific constructions that accept different adjectival verbs according to their individual semantics.

As an extension of her crosslinguistic research on the acquisition of predicate semantics, Bowerman investigated how children acquire the categories of event-participants associated with particular predicates. Languages differ strikingly in the amount of event-participant information encoded in their predicates, and in the particular categories of participants

that are relevant for events of different kinds. For example, to talk about events of holding and carrying, speakers of Tzeltal Maya must select among verb roots depending on where and how on the body the object carried is supported (e.g., on head, in arms, on shoulder, in hand supported from above), while speakers of Navajo must choose a verb root according to properties of the carried object itself (animate, long, bulky, a container with contents, etc.). Constraints that predicates impose on participants include traditional "selection restrictions" on core arguments, but go well beyond these – e.g., the associated body part is not an argument of carrying verbs in Tzeltal.

Children learning English and other European languages often fail to respect predicate constraints on event participants; e.g., they apply *break* to the tearing of cloth or paper, *open* to taking a piece out of a jigsaw puzzle, and *cut* to smashing a walnut with a mallet or crushing ice with a rolling pin (Bowerman 1978 and unpublished data; E. Clark 1993). These errors seem to suggest that children start out with relatively undifferentiated event meanings and only later constrain them by adding in finer participant specifications. But crosslinguistic data belie this learning scenario: e.g., from the earliest stages of language production, learners of Korean differentiate accurately among verbs for putting clothing on various body parts (Choi & Bowerman 1991), and learners of Tzeltal discriminate among several verbs for carrying objects and several verbs for eating objects of different kinds (e.g., meat, soft, crunchy, grain-stuff, see P. Brown 2001).

To understand what influences children's inclusion or neglect of participant information in their early predicate meanings, Bowerman compared crosslinguistic data from English (work by Bowerman, Schaefer), Korean (Choi & Bowerman), and three Mayan languages (Tzeltal, P. Brown; Tzotzil, de León; and K'iche', Pye) on children's use of everyday predicates to do with events of holding/carrying, eating, object placement, opening, breaking, and cutting. She found that neglect of participant information is indeed not a general feature of predicate acquisition, but varies systematically according to the semantic structure of the predicate being acquired (see also below under 9.3.3). Everyday predicates that impose few or no participant restrictions (e.g., English *carry* – any patient, and *up* or *in* – any theme) are learned readily and used with few errors. At the other extreme, predicates associated with relatively *concrete* categories of participants – i.e., participants that share many perceptual properties, such

as certain body parts or kinds of food, or containers with a certain shape – are also easy to acquire. Compared to learners of English, learners of Mayan languages and Korean must master many verbs of this type.

More problematic for learners are predicates associated with participant categories that, although somehow constrained, include highly diverse members. For example, English *cut* imposes constraints on a (nonargument) instrument participant: "cutting" can only be done by applying pressure with the *linear edge* of an object. This constraint rules out severings accomplished with mallets and rolling pins, but is generous enough to encompass knives, scissors, pieces of glass, paper, or wire, grass blades, fingernails, and so on. The diversity of instruments observable in events labeled by *cut* obscures the feature they have in common, and may suggest to the child that the precise properties of the instrument are not very important – hence, errors like the application of *cut* to an event of nut-cracking. English *open* and *break* are also associated with highly diverse categories of participants, and also give rise to many overextensions. The systematic relationship between error patterns and the specificity and make-up of the participant categories to be learned supports the view (Bowerman & Choi 2001) that from the earliest stages of language acquisition, children are capable of *constructing* semantic categories through observation of adult uses of a word.

9.3 Event construal and event encoding

In telling about something they have experienced, speakers have choices about how to encode it. For example, they could describe the same situation with either *John kicked on the door and it opened* or *John kicked the door open*, but these two sentences present or "construe" what happened in different ways – the first as a sequence of two events, and the second as a single, albeit complex, event. Languages differ in the alternative construals they allow, and in the factors that tip the choice in favor of one alternative or another on a particular occasion. Even when two languages offer similar options, their speakers may differ systematically in their preference for one over another. Continuing a focus introduced earlier (Annual Report 2001), several subprojects investigated complex predicates, including multiverb constructions in which two or more verbs are used in combination to express what is at some level construed as a single event. Two content areas that give rise to variation between

simple and complex encoding, causality (including events of cutting and breaking) and motion, are pulled out in what follows for a closer look.

9.3.1 Complex predicates

Senft continued his research on event reports and event conceptualization in languages with and without serial verb constructions (SVCs) (Annual Report 2001). During his field trip to the Trobriand Islands (Papua New Guinea), Senft used the video clips and photographs of the Staged Events elicitation tool to elicit data from five speakers of Kilivila. The resulting language corpus, encompassing 860 event reports, is being incorporated into the Institute's archive of (endangered) language materials, and made publicly available – along with the Staged Events data elicited by Schiering (U. Köln) and Senft for three speakers each of English and German (Annual Report 2001) – on the Institute's web site. These data constitute the basis for testing Westermann's (1907) classic hypothesis that languages with SVCs segment events with finer granularity than languages without these constructions. To test this hypothesis, Senft is examining the SVCs Kilivila speakers use to report events of various types. First analyses show that many event reports follow a specific schema. For example, for an event in which an entity moves from point A to point B, speakers typically use a contiguous SVC (i.e., a construction in which verbs are juxtaposed with no intervening NPs) consisting of a manner-of-motion verb, a verb of inherently directed motion encoding departure, and another verb indicating arrival at a goal. For example:

- (11) E-lola e-la e-loki ma-kwela-na baketi.
 3-walk 3-go 3-go.and. arrive DEM-CLF.potlike-DEM bucket
 'He walks he goes he goes and arrives at this bucket.'

At first sight these schemas do look finer grained than event descriptions elicited from speakers of English and German (languages without SVCs), but comparisons suggest that they typically are not actively constructed by speakers as they describe an event, but rather constitute prepackaged phraseological units or speech formulae.

Ameka continued his investigation into the typology of multiverb constructions in Kwa languages of West Africa, including Ewe. A specific issue explored is the expression of subject arguments in multiverb constructions for which the verbs share the same subject or have different subjects. Earlier work (Annual Report 2000) showed that in one type of multiverb construction in Ewe, the subject of the verb of the second clause

of a biclausal sentence can be realized as a dependent personal pronoun such as *wò* (3SG). The antecedent of this pronoun can be a nonsubject argument of the preceding clause, as in (12a); alternatively, it can be the whole state of affairs described in the first clause or just that part of the event represented by the verb phrase, as in (12b). Which interpretation is intended is determined on the basis of the context.

(12a) *É-fo* *ame-a* *wò-dze* *anyí.*
 3SG-strike person-DEF 3SG-land ground
 'S/he hit the person (and) he fell down.'

(12b) *É-fo* *nu* *wò-didi.*
 3SG-strike mouth 3SG-long
 'S/he talked (it was) long.' (i.e., 'his/her talking was long' – whole state of affairs, or 'the "talking" [=speech] was long' – VP only.)

Now Ameka has found that the second clause's subject can also be realized as the singular impersonal pronoun *é*, as in (13), or as a spatio-temporal nominal functioning as a situational anaphor, namely, *égbe* 'today' and *é-tefé* 'its place', as in (14) and (15):

(13) *É-fo* *nu* *é-didi.*
 3SG-strike mouth IMPERS.SG-long
 'S/he talked it was a long time.'
 (It was a long time since she had talked)

(14) *É-fo* *nu* *égbe* *didi.*
 3SG-strike mouth today long
 'S/he talked a long time ago.'
 (the time of speaking is distant from today)

(15) *É-fo* *nu* *é-tefé* *didi.*
 3SG-strike mouth IMPERS.SG-place long
 'S/he talked (its place and time is) distant.'

As the glosses suggest, the form of the subject of the second clause indexes specific features of the first clause. Although a dependent personal pronoun can refer to the whole state of affairs of the first clause, as in (12b), and the impersonal pronoun must do so, as in (13), the meanings they convey are different: in (12b) the second clause describes the duration of the event of the first clause, while in (13) it characterizes the time of its occurrence with respect to some contextually given reference time. The temporal noun 'today', as in (14), also locates the time of occurrence of the event of the first clause, but it does so deictically by

information encoded by X. The two templates share some, but not all properties. In the X-V template, X may be a transitive state-change verb (in which case ambiguity between an X-V and a V-V reading arises), but it is more often a stative predicate, an ideophonic particle, or an activity verb such as *bàaxal* 'play' in (17):

- (17) Ko'x bàaxal+ts'òon!
 EXHORT play+shoot
 'Let's play-shoot!' (i.e., pretend to shoot)

The semantic link that licenses V-V compounds as an extension of X-V compounds is "manner so as to cause": The V2 event is understood to be conducted in such a manner as to cause the V1 event if no circumstances intervene to thwart realization of the latter. This explains the defeasibility of V1 realization, the anti-iconic ordering in V-V compounds (V1 filling the X-slot), and the basic intransitivity of V-V compounds (X-V compounds do not encode causal relations, a condition on transitivity in Yukatek). Since the X-V template does not encode causality, neither does the V-V template. Instead, causality is encoded in both roots in V-V compounds (hence the restriction to transitive roots). Thus, "manner so as to cause" is realized in (16) as 'affect the rock by hitting it IN THE MANNER OF causing it to crumble' (where V2 contributes the meaning 'affect the rock by hitting it', V1 contributes 'cause the rock to crumble', and the X-V template contributes 'in the manner of'). In order to license the linking of the participants of both subevents to syntactic arguments, V-V compounds must be "re-transitivized" by applicative derivation. Aside from drawing attention to the "manner so as to cause" construal, Bohnemeyer's analysis contributes to the understanding of the principles that govern the encoding of complex events in complex predicates.

O'Connor investigated predicates of change in Lowland Chontal, an underdocumented and endangered unclassified language of southern Mexico. In Chontal, changes of location, position, and state are expressed with two types of complex predicates. One type involves compound stems formed with an element of directional motion, and the other involves a small set of derivational suffixes of "associated motion" (cf. Wilkins 1991 on Mparntwe Arrernte) that in Chontal associate a subevent of deictic motion to the predication of the main verb. Examination of the second type of complex predicate revealed intriguing twists when this change-of-location verbal morphology is used in expressions of change of state. The translocative and dislocative associated motion suffixes each contribute a

"motion away" subevent to the predication. The translocative distinguishes 'he went and planted' ('plant'-TRANSLOC-PERFECTIVE) from 'he planted' ('plant'-PERFECTIVE). The dislocative conflates 'motion away' and imperfective aspect: 'he will go and plant' ('plant'-DISLOC), as distinct from 'he will plant' ('plant'-IMPERFECTIVE). However, when the two associated motion derivational patterns are applied to a small set of change-of-state verbs, the semantic transfer of "motion through space" to "evolution through time" seems to reverse entailments about the full realization of the event: the translocative + perfective pattern now gives an inchoative instead of a perfective meaning, e.g., 'he is getting tired' ('tire'-TRANSLOC-PERFECTIVE), and use of the dislocative suffix now produces a result state reading of a presupposed change, as in 'he is tired', 'he has become tired' ('tire'-DISLOC). The proposed explanation for the seeming mismatch focuses on the distinct stages of a change event. For both change-of-location and change-of-state verbs derivation with the translocative highlights the *initial stage* of change, as the participant departs from the source location or state, while use of the dislocative highlights the *final stage* of change, as the participant arrives at the goal location or state.

9.3.2 Causality

Members of the Language and Cognition and the Acquisition Groups have started a new comparative subproject, coordinated by Bohnemeyer, Bowerman, Majid, and van Staden, on the encoding of causal events of cutting and breaking (i.e., events of the type that are typically described with predicates such as 'cut', 'break', 'slice', 'hit + break', etc.). This domain displays striking crosslinguistic variation in predicate semantics, in the complexity of event encoding, and in the syntactic treatment of arguments, and so poses challenging questions for both field linguists and language acquisition researchers.

Project members elicited descriptions of events of cutting, breaking, and certain "similar" acts of separation (e.g., "opening") from speakers of 22 genetically and geographically diverse languages, using a standardized set of video stimuli (the Cut and Break stimuli) designed for this purpose by Bohnemeyer, Bowerman, and P. Brown. Two main questions motivated the analyses undertaken in 2002. First, for a given cutting or breaking event, where do languages encode the information on the nature of the separation? It is often assumed that this kind of information will be encoded in the main verb (cf. English *cut* and *break*). But how many languages actually have simple nonderived verbs in simple clause

constructions for encoding cutting and breaking events? And are some types of cutting and breaking events more likely to receive a simple encoding than others? Second, when languages do have such verbs, what do they mean – which of the many conceptually relevant aspects of the events (instrument, manner, properties of the affected object, configuration of the resulting parts, degree of completion, etc.) do they encode?

In a first analysis of the data sets, the researchers transcribed the elicited descriptions and indicated whether the physical event of separation in each clip was encoded by a simple verb (i.e., a single monomorphemic verb like "cut") or a complex construction (e.g., serial verb – 'hit-break', verb plus resultative particle – 'cut off', or causativized verb – 'break_{intr}'-CAUSE). For each of the languages analyzed so far, the proportion of responses that contained a simple verb was calculated. Table 9.1 shows the languages, along with the researchers who collected and analyzed the data, ranked from those with the highest to those with the lowest proportion of simple verbs. Speakers of some languages, e.g., Yéllí Dnye, used simple verbs to describe the vast majority of stimuli, while speakers of others, e.g., Miraña and Hindi, used almost no simple verbs at all. Within the languages, the distribution of simple verbs across stimulus events was not arbitrary; e.g., if speakers used any simple descriptions at all, they applied them at least to peeling fruit and certain opening scenarios. Complex descriptions were associated with a variety of factors, such as use of nonprototypical instruments, partial or very precise separations, and repetitive actions. Research is now underway to compare the semantics of cut and break expressions, the factors contributing to the choice of a specific expression in a specific construction, and children's acquisition of such expressions.

	Language	Language Affiliation	Researcher	MOST LIKELY
1	Yélf Dnye	Papuan	Levinson	
2	Sranan	Creole	Essegbey	
3	Tzeltal	Mayan	P. Brown	
4	Ewe	Niger-Congo	Ameka	
5	Spanish	Indo-European	Palancar (U. Querétaro, Mexico), Bowerman	
6	Kilivila	Austronesian	Senft	
7	German	Indo-European	van Staden	
8	Turkish	Turkic	Özyürek (Koç U.), Majid	
9	Yukatek	Mayan	Bohnenmeyer	
10	Tiriyó	Cariban	Meira	
11	Tidore	Papuan	van Staden	
12	Japanese	Isolate	Kita	
13	Lao	Tai	Enfield	
14	English	Indo-European	Wegener, Bowerman, Majid	
15	Swedish	Indo-European	Gullberg	
16	Punjabi	Indo-European	Majid	
17	Dutch	Indo-European	van Staden	
18	Jalonke	Niger-Congo	Lüpke	
19	Mandarin	Sino-Tibetan	Chen	
20	Chontal	Isolate	O'Connor	
21	Hindi	Indo-European	Narasimhan	
22	Miraña	Witotoan	Seifart	LEAST LIKELY

Table 9.1: Languages in decreasing order of likelihood of using a simple verb for encoding cutting and breaking events.

In work on the nature of mental representations constructed during language processing, Majid, together with Sanford (U. Glasgow) and Pickering (U. Edinburgh), investigated how causal inferences are influenced by linguistic cues. Work on narrative understanding has catalogued a number of different types of coherence relations that people can use to connect events, but it is unclear what promotes an inference of one kind over another. Many experimental studies have suggested that people generally have a preference for causal inferences, but this claim

has been challenged by two recent studies (Stevenson, Crawley, & Kleinman 1994; Arnold 2001) that argue that consequential inferences are in fact more common. Why outcomes conflict is unclear: The materials presented to the subjects in these experiments are typically so complex that it is difficult to determine which part of the information subjects used in generating a particular coherence relation. To shed light on this issue, Majid et al. conducted three experiments in which English-speaking subjects were presented with minimal scenarios such as *John apologized to Mary...*, and asked to produce a continuation. The predicates in these scenarios were (i) Agent-Patient verbs (e.g., *kicked*), (ii) Stimulus-Experiencer verbs (e.g., *loved*), or (iii) Agent-Patient-Recipient verbs (e.g., *gave*). Continuations were coded for whether they were causal, for example *...because he felt bad*, consequential *...and so she forgave him*, or narrative *...however, Mary wasn't listening*. Subjects overwhelmingly made causal inferences for both Agent-Patient and Stimulus-Experiencer verbs, but narrative continuations for Agent-Patient-Recipient verbs. This suggests that verb type influences participants' preferences for coherence relations.

Majid et al. also investigated how natural language quantifiers in English affect people's causal inferences. An extensively researched factor influencing causal attribution is covariation information. Researchers typically manipulate covariation information by presenting subjects with textual vignettes that indicate whether the number of people participating in some event is many (high covariation) or few (low covariation), followed by a target event about which subjects have to make a causal attribution. For example, given the target event *John liked Mary*, subjects are likely to attribute the cause of the event to John if they have been told that *Few people liked Mary* (low covariation information), and to Mary if they are told that *Many people liked Mary* (high covariation information). The purpose of such research is to study how people's perception of frequency information influences their causal reasoning; however, researchers impart frequency information not by letting subjects observe real events but through natural language quantifiers such as *few* and *many*. This practice introduces a confound: the quantifiers not only convey information about quantity, but also put a particular perspective or focus on the information (e.g., *few* focuses attention on those who do *not* participate in the event – Moxey & Sanford 1993). Majid et al. manipulated quantity and focus orthogonally by presenting covariation information with one of four quantifiers: *few* (small quantity + focus on those who do *not* participate in

an event); *a few* (small quantity + focus on those who *do* participate); *not quite all* (large quantity + focus on nonparticipants); *nearly all* (large quantity + focus on participants). Only the focus information influenced causal attributions: people gave the same causal attributions to *few* and *not quite all* (nonparticipant focus), which were different to those given for *a few* and *nearly all* (participant focus). This suggests that causal inferences derived from natural language quantifiers such as *few* are based primarily on information perspective, not covariation information.

9.3.3 Motion

In a crosslinguistic developmental study of event encoding, Bowerman, P. Brown, Eisenbeiß, Narasimhan, and Slobin (U. California, Berkeley) explored how different languages describe *placement events* (e.g., putting a book on a table; pouring milk into a glass), and how children begin to talk about such events in their early multiword utterances. In his well-known typology of how languages encode motion events, Talmy (1991) distinguishes between "verb-framed" and "satellite-framed" languages (here, V-languages vs. S-languages for short) on the basis of where information about path (e.g., motion "in", "out", "up", "down", "across") is characteristically encoded in the clause: in the main verb in V-languages (with manner information optionally encoded in a separate clause or phrase, e.g., Spanish *entrar volando* 'enter flying'), or in a "satellite" to the verb – e.g., particle or prefix – in S-languages (with manner information typically expressed in the main verb, e.g., English *fly in*). Bowerman et al.'s study was based on longitudinal spontaneous speech samples from learners of four S-framed languages (Finnish, English, German, Russian) and four V-framed languages (Hindi, Tzeltal, Spanish, Turkish).

Children were found to tune in early to the broad typological characteristics of their language: in their earliest multiword constructions expressing placement events, learners of V-languages were far more likely to include a verb than speakers of S-languages, and less likely to include a nonverbal element expressing direction or spatial relationship. The binary split between S- and V-languages does not, however, explain all the variation among children; for example, the preference for verbs vs. nonverbal directional/spatial elements was not dichotomous, but distributed along a continuum. To account for this, the researchers invoked features that crosscut Talmy's typology, such as differences in the relative perceptual salience of satellites and other grammatical morphemes that encode spatial relations.

Four substudies explored intratypological variation in more detail. The first two examined the impact on acquisition of the semantic specificity of path morphemes (both grammatical elements and verbs). In Finnish, the locative cases used to mark goal phrases make a four-way distinction based on two crosscutting contrasts: containment vs. support and dynamicity vs. stasis. The locative cases of Hindi and Turkish make only a two-way contrast, but in different ways: Hindi distinguishes containment and support, collapsing across dynamic/static, while Turkish distinguishes dynamic vs. static, collapsing across containment/support. Spanish requires none of these distinctions: the preposition *en* 'in(to)', 'on(to)' can be applied to events of all four types. At the early two-word stage, learners of Spanish, Hindi, and Turkish all mark their goal phrases relatively appropriately whereas Finnish children make errors. This might suggest that systems with fewer distinctions are acquired more easily than those with more distinctions. Compatible with this hypothesis, the verbs initially used by learners of German and English to express placements are primarily "light" verbs such as English *put*, *do*, and *make*, even though adult German speakers routinely distinguish between *stellen* 'set' and *legen* 'lay'. But learners of Tzeltal use not only a general verb meaning 'give' or 'put', but also distinguish appropriately among several semantically much more specific verbs, such as *ch'ik* 'insert something between supports' and *pach* 'put' for bowl-shaped objects. Categories with more distinctions are not, then, necessarily harder to learn (see also 9.2.3 above).

In a second substudy of the role of semantic specificity, P. Brown and Narasimhan explored Hindi and Tzeltal children's early uses of containment terms (e.g., the Hindi locative case-marker *-mE* 'in'; the Tzeltal verb *och* 'enter'). One question was whether – given that categories with more distinctions had not been found to be harder than those with fewer distinctions – children might in fact initially *prefer* highly specific terms, and even restrict their use of any general terms they have acquired to very specific contexts. This hypothesis was not borne out. Learners of Tzeltal were indeed quick to acquire specific verbs such as *lut* 'lodge tightly between objects' (e.g., lips, fork in tree), but learners of both languages used general containment terms across a variety of contexts from an early age. If children have any tendency to prefer very narrow, object-specific schemata for their early containment words, this phase is short-lived: rapid generalization is promoted by factors such as frequency and diversity of contexts of use in the input.

A third substudy of intratypological variation (in collaboration with Behrens, now U. Groningen) compared the expression of locative goals in the acquisition of English and German. These two closely related languages offer similar options for expressing a goal participant, but word order and other differences between the languages make the exercise of these options more flexible in English. An English sentence like *Put the book in* can either end at this point or be continued with an explicit goal phrase (*Put the book in... the box/it/here/there*). The German equivalent, however – *Leg das Buch rein* 'lay the book therein' – cannot be followed by a goal phrase; if the speaker wants to mention the goal explicitly, e.g., because the listener has not understood, the whole utterance must be reformulated. The greater flexibility of English suggests that English speakers may explicitly mention goals more often than speakers of German. A case study comparing two children and their parents confirmed this: the English learner's parents mentioned goals about twice as often as the German learner's parents, and the same asymmetry was apparent in the children's speech. Thus, speakers of two closely related languages belonging to the same typological pattern can differ in their preferred patterns of event encoding, and children acquire the stamp of their own language very early.

The final substudy examines the role of *variation sets* (Slobin & Küntay 1995) in adult input in revealing to children how their language encodes placement events. A variation set is a series of utterances produced with a constant communicative intent, but with changing form. Such sets could provide clues about the typological characteristics of the target language. Variation sets around placement events were found to occur frequently in adult speech to learners of English, Russian, Hindi, and Turkish, and they highlight critical features of the semantics, morphology, and syntax of the target language. For example, in a Hindi variation set around a proposition like 'put the milk_{object} in_{spatial relation} the refrigerator_{goal}', the verb is always present, while all other elements come and go; variation sets in English, in contrast, frequently revolve around alternative ways to express the goal (*in the refrigerator, in, right in, in there, right in the refrigerator*). Repeated exposure to such variation sets throws critical aspects of language-specific morphosyntax into relief.

Overall, the suite of crosslinguistic studies just described show that multiple factors interact from early on to influence language-learners' preferred patterns of encoding placement events. These include the broad typological characteristics of the language being learned, the relative

perceptual salience and the semantic structure of path morphemes, and discourse framing in the input.

Kita, together with Allen and A. Brown (Boston U.) and Özyürek and Turanli (Koç U., Istanbul), investigated how English- and Turkish-speaking children express manner and path in describing motion events. As described in the introduction to this subsection, languages differ in their characteristic patterns of encoding motion: in Talmy's typology, English is a satellite-framed language and Turkish is a verb-framed language. It has been unclear at what stage children become sensitive to the pattern of their own language: do they start out with a universal default pattern, and tune in only later to the language-specific pattern (e.g., Slobin 1985), or do they follow a language-specific pattern from their earliest productions (e.g., Bowerman & Choi 2001)?

Data were collected from 20 Turkish-speaking children (mean age 3;8), 20 English-speaking children (mean age 3;9), and 20 adult speakers of each language. Each subject was shown 5 video clips of motion events crucially incorporating both manner and path (e.g., a round "Tomato Man" rolling down a hill), and asked to narrate each in turn to an adult listener. Each of a subject's narrations was coded for whether it contained at least one sentence of each of the following four types: a sentence with (1) a manner verb only (e.g., *he rolled*), (2) a path verb or a directional particle only (e.g., *he descended*, *he went down*), (3) a manner verb plus a directional particle/preposition/adverbial (e.g., *he rolled down*, *he rolled downhill*), (4) a manner verb and a path verb in a matrix-subordinate construction (e.g., *he descended while rolling*, *he exited flying*).

Results from the adult data show crosslinguistic differences roughly along the lines of Talmy's typology (see Annual Report 2001: 45-46, and the Gesture Project section of this Report for related results). English speakers typically expressed both manner and path in a sentence with a single verb (e.g., *rolled down*), whereas Turkish speakers typically expressed these two concepts in a sentence with two verbs: a path verb in a matrix clause and manner verb in a subordinate construction (in rare cases, Turkish speakers used a manner verb plus a directional adverbial, analogous to e.g., *rolled downhill*). Results from the child data show both language-specific and shared patterns. English-speaking children produced sentences containing both manner and path elements more frequently than Turkish-speaking children, and – for utterances containing both meaning components – the two groups of children relied on different

constructions: more sentences with a verb plus a directional particle/preposition/ adverbial in English, and more sentences with a matrix-subordinate construction in Turkish. Both groups of children used sentences containing both manner and path less frequently than adult speakers of their language. This is probably due to processing limitations. Processing difficulties may also explain why learners of Turkish produce fewer manner + path combinations than learners of English, since it presumably takes more processing resources to construct a matrix-subordinate construction than to construct a combination of a verb plus a directional particle/preposition/adverbial.

10 THE ROLE OF FINITENESS

This project grew out of the former Institute project the Acquisition of Scope Relations (Annual Report 2000). It focuses on one out of four topics pursued there – the structure and functioning of "finiteness" in first language acquisition, second language acquisition and also in adult language. The distinction between finite and nonfinite verb forms is familiar from the days of the Greek grammarians; but it has never found a proper definition. Traditionally, it is primarily seen as a morphological phenomenon: verb forms that are inflected for tense, mood, person, number and maybe other categories are considered finite, all others are considered nonfinite. This view is unsatisfactory for at least two reasons. First, the distinction between finite and nonfinite forms is also made when there is hardly any morphological distinction on the verb. Thus, most English verb forms can be finite as well as nonfinite. Second, numerous syntactic, semantic and pragmatic phenomena are associated with the presence or absence of finiteness. These include basic word-order rules, the licensing of grammatical subjects and of expletive elements, constraints on gapping, nonspecific readings of indefinite noun phrases in nonfinite constructions, the temporal interpretation of verbal elements, the role of temporal adverbials, and the interaction with focus particles such as *only* or *too*. It appears, therefore, that finiteness is not a mere fact of verb morphology but a grammatical category in its own right. As a working hypothesis, the members of the Project assume that finiteness (a) relates the descriptive content of a sentence to its "topic component", in particular to the time span ("topic time") about which an assertion is made, and (b) marks this relation as "positive", in other words, finiteness functions as the carrier of assertion in an utterance. In nondeclarative clauses, it reflects

other functional properties of the clause as a whole. Many of the structural repercussions of finiteness seem to follow from this analysis.

10.1 Finite forms, nonfinite forms and temporal variables

Klein continued his reanalysis of the traditional temporal parameters that Reichenbach (1947) identified as "S" (for "speech point"), "E" (for "event point") and "R" ("reference point"). Among these, R has hardly ever been given a falsifiable interpretation. But S and E also raise numerous problems. S is traditionally seen as the "speech time". But how long is the time of the speech event? Is it the time which it takes to utter the sentence? Many deictic words require a speech time shorter than that. Consider the utterance *From now, it is precisely three seconds to now*. Does it have one or two speech times? Apparently, we must distinguish a "speech time" that is decisive for the tense marking of some sentence from several "speech times" that are decisive for deictic adverbials within the same sentence. Another case are sentences such as *It will surprise you to hear that Bill has left*. The "surprise time" takes place while the last part of sentence is uttered and heard, but the tense marks it as being in the future.

Another problem occurs with longer stretches of discourse. Does each sentence in a text have its own speech time? Many texts follow the principle of natural order: "Unless marked otherwise, order of mention corresponds to order of events". This principle explains why sequences such as *He fell asleep and turned the light off* are odd. Such a principle only makes sense if there is a sequence of speech times WITHIN a text. Instead of a single "speech time", we have a set of temporally related time spans that are characterized by particular properties, such as the property that someone says something.

A third problem has to do with this property that characterizes S: It need not be the property that someone says (or writes or hears or reads) something at that time. Consider the following sentence from the German penal code:

- (1) § 9. [Ort der Tat] (1) Eine Tat ist an jenem Ort begangen, an dem der Täter gehandelt hat oder im Falle des Unterlassens hätte handeln müssen oder an dem der zum Tatbestand gehörende Erfolg eingetreten ist oder nach der Vorstellung des Täters eintreten sollte.

'§ 9. [Place of offense] (1) An offense has been committed at the place at which the offender acted or, in case of neglect, should have acted or at which the result pertaining to the facts of the case has occurred or should occur according to the offender's conception.'

This sentence contains many tense forms, *ist begangen, gehandelt hat, hätte handeln müssen, eingetreten ist, eintreten sollte* ('has committed, has acted, should have acted, has occurred, should occur'). What is its S? It is surely not the time at which the law was issued, or at which the reader reads it. Still, such uses of tense forms are by no means exotic.

Therefore, the notion of a point or interval S should be replaced by the notion of a (*clause-external*) *temporal structure*, to which the "event" can be linked. It consists of a set of clause-external times that can be characterized in different ways. Such a clause-external time can be the time at which the entire utterance or a part of it (as in the case of *now*) is uttered; it can also be some other contextually given time. In subordinate clauses, it can be the time of a matrix verb, especially if this verb is a *verbum sentiendi vel dicendi* (perception or communication verb). In this case, ambiguities may arise because there are several possible clause-external times, to which the event can be linked.

What is E? Most authors consider it a time span of undefined length, during which the "event" takes place, or could take place. Thus, in *Caxton left*, it is the time at which the "leaving event" took place. Consider now (2), which involves at least five different time spans:

(2) (external), Caxton seemed to have planned to come at five

t_{ex} t_1 t_2 t_3 t_4 t_5

- (a) t_{ex} is after t_1 , the "time of seeming"
- (b) t_1 overlaps with t_2 , the "posttime of planning"
- (c) t_2 is after t_3 , the "time of planning"
- (d) t_3 is before t_4 , the "time of coming"
- (e) t_5 is most likely identical with t_4 ; but other readings are possible
- (f) t_1 overlaps with t_2 , and t_2 in turn overlaps with t_4 .

Which of these is E? Apparently, what we have here is a whole array of time spans, each characterized by one or several descriptive properties. There is no single "event time" but a (*clause-internal*) *temporal structure*. It consists of several interrelated temporal intervals, the topmost of which is related to the clause-external temporal structure. It is this relation which is traditionally captured under the label of "tense", whereas clause-internal temporal relationships give rise to aspectual differentiation.

Matsuo investigated how English- and Dutch-speaking children interpret present and perfect participles used attributively as in (3) and also in more complex contexts as in (4):

(3a) burning candle/boiling water/melting ice cream (present participles)

(3b) burned candle/boiled water/melted ice cream (perfect participles)

(4a) This morning, the penguin gave melting/melted ice cream to Mr.Cow.

(4b) The girl asked for melting/melted ice cream for her party tonight.

The difference between (3a) and (3b) is intuitively very simple; in the first case, the candle must be in the middle of burning, whereas in (3b), the burning must be over. Klein (2002; cf. also above) argues that the time index of participles (e.g., the time of burning in (3a) and the "posttime" of burning in (3b)) must be related to the "time of some governing verb". However, when there are no other time-bearing variables, as in (3), the time of the participle is interpreted with respect to speech time. This anchoring becomes more complex in (4). In (4a), the (post)time of melting must be anchored to the time of giving; in this context, "this morning". In (4b), it must be anchored to the time of the party (in this story "tonight"), but not to the matrix event time, i.e. the time of asking. Klein (p.c.) claims that the reason why the time of the participle cannot be anchored to the matrix event time in (4b) is because the matrix verb *ask for* is an intentional verb. Klein's analysis predicts that children show more difficulties in (4) compared to (3), if intensional verbs are more difficult to comprehend or process; however, this analysis does not speak to a difference between present and perfect participles.

Ten English speaking children (ages ranging from 3;3 to 5;11) plus three adult controls participated in the English part of the experiments and 17 children (ages ranging from 5;6–7;0) participated in the Dutch part. Experiment 1 included test items as in (3); with only NPs with prenominal participles to avoid any influence from tense-bearing items (verbs, adverbs etc.). A picture-choice task was used with 5 test items. In this task, the children were shown two pictures with each linguistic test item and were asked to choose the right picture for each item. Experiment 2 included more complex sentences, such as (4), and a truth-value judgment task (Crain and McKee, 1985) was employed. An ANOVA analysis found that the responses given to present and perfect participles are significantly different from each other. Both English and Dutch children had more success with present participles than perfect participles in both

Experiments 1 and 2. Also, children found the relative future context in (4b) more difficult than the relative present context in (4a) or the speech-time context in (3), this suggests that the analysis given in Klein (2002) correctly predicts the comprehension of participles by young children that are acquiring English or Dutch.

Schmiedtová in collaboration with Roeper (U. Massachusetts, Amherst) likewise studied the acquisition of complex temporal structures involving more than one time interval in the use of present participles. Their research focused on the contrast illustrated in (5) – (6):

(5) John saw the team winning. Time of the participle dependent on time of the matrix verb – Event-related reading

(6) John saw the winning team. Time of the participle unrelated to time of the matrix verb – Time-independent reading

The research question of their project was: How and when does a child realize that in (5) the time of the participle is interpreted as overlapping with the time of the matrix verb, while in (6) the two times are unrelated? This question was tested with 24 monolingual English children aged 3;7–5;5 examining their comprehension of stories, presented in pictures, with respect to six scenarios such as the following:

Experimenter: "Look here, it's morning and Ben just went to school. The dog is sleeping. But look there is another dog, a black one. The black dog is barking."



Figure 10.1: First picture – the dog sleeping; the boy away

Experimenter: 'Look here, the dog is awake now. He is feeling much better after his nap and he is wagging his tail. Ben just came back from school and they want to play together.'



Figure 10.2: Second picture – the boy present; the dog awake

With respect to this sequence of pictures, the children were asked questions such as (7) – (8):

- (7) Did Ben see the dog sleeping? (Expected answer: no) – Event-related reading
 (8) Did Ben see the sleeping dog? (Expected answer: yes) – Time-independent reading

Of all the children 70.1% answered correctly (no) to questions of type (7) and 57.8% of all children answered correctly (yes) to questions of type (8). All children who responded correctly to both (7) and (8) were older than 4;4. Out of all the children younger than 4;4 65.7% interpreted questions of type (8) incorrectly and 78.2% interpreted questions of type (7) correctly. This shows that children younger than 4;4 first master the event-related reading and only later (around age 4;4) acquire the time-independent reading.

These preliminary data suggest that, initially, several temporal forms, independent of how they are syntactically related to each other, are interpreted as referring to the same time (simultaneity in a broader sense). The concept of simultaneity is automatically projected onto the syntax of

small clauses. That might be the reason why the event-related reading is adopted by children younger than 4;4 as a default interpretation for cases where the time-independent construction is required in the adult language.

10.2 Finiteness in learner language

The information-structural and grammatical role of finiteness becomes apparent in language acquisition. Dimroth & Jordens (VU Amsterdam) compared developmental processes in the acquisition of finiteness by children learning Dutch as their mother tongue and Moroccan-Arabic and Turkish learners of Dutch as a second language. They investigated spontaneous production data that were collected longitudinally. The L1 data were taken from an extensive diary study, the L2 data stem from the European project Second Language Acquisition by Adult Immigrants. It was found that developmental processes in children and adults are remarkably similar. Initially, utterances are based on principles of information structuring. At the relevant stage, which is referred to as the "conceptual ordering stage" (COS), these utterances may consist of three structural positions (cf. Table 10.1). The initial position is taken by elements with reference to space, time, or by elements with external reference either to the outside world or to the previous utterance. These elements typically have anchoring function and are therefore referred to as "topic" elements. Elements referring to an activity, a state or a result occur in final position. They describe a particular state of affairs which holds for the topic. Due to this functioning they are categorized as "predicate". elements occurring between the topic and the predicate are termed "link". They are used to validate the relation between the topic and the predicate by the expression of illocutionary force.

CONSTITUENT	TOPIC	LINK	PREDICATE
INFO-STRUCT. FUNCTION	anchoring	validation: illoc. force	state of affairs
EXAMPLES	<i>disse</i> 'his <i>die jongen</i> 'that boy	<i>hoenie</i> has-to-not <i>misschien</i> maybe	<i>meeneme</i> with-take' <i>weten niet</i> know not'

Table 10.1. Structural and functional organization in L1 and L2 learner utterances (conceptual ordering stage)

At the COS, elements have no target-like grammatical function. Thus, syntactic functions such as subject, object or finite verb and syntactic

relations such as head-complement and specifier-head agreement are not yet established. The information-structural function of elements may explain why at the relevant stage utterances of child first-language and adult second-language learners of Dutch are so remarkably similar.

Further investigation by Dimroth and Jordens showed that the acquisition of auxiliary verbs has a major impact on the developing system. At the "finite linking stage" (FLS) it establishes a functional category system with syntactic relations such as head-complement and specifier-head agreement.

Adult second-language learners, however, differ from children with respect to the acquisition of verb-second order. Finite verbs in child utterances are always used correctly, they are produced either as verb-first or verb-second. This can be illustrated with examples as in (9):

- | | | |
|-----|---------------------------------|--------------------------------|
| (9) | die <i>heef</i> mama maakt | 'that-one has mommy made' |
| | <i>mag</i> jij opete | 'may you up-eat' |
| | da <i>kan</i> ik niet meer lope | 'there can I not anymore walk' |
| | nou <i>mag</i> papa weer teke | 'now may daddy again draw' |

In second language learner varieties however, finite verbs may typically occur in verb-third position. Examples:

- | | | |
|------|---|---------------------------------------|
| (10) | toen hij <i>mag</i> werken | 'then he may work' |
| | dan hij <i>heeft</i> beetje hard rijden | 'then he has a-bit fast drive' |
| | soms ik <i>heb</i> hele dag niet werken | 'sometimes I have whole day not work' |

Jordens further investigated this difference between adults and children, focusing on properties of the input. In Dutch subordinate clauses, the finite verb always occurs in (pre)final position. However, since some adverbs, e.g., *toen* 'then' and *wanneer* 'when', are homonymous with complementizers, subordinate clauses with such complementizers can easily be misanalyzed as main clauses with adverbs and verb-third. Examples in target Dutch:

- | | | |
|------|--|------------------------------|
| (11) | toen ik <i>had</i> geslapen, | 'when I had slept,' |
| | voelde ik me weer beter | 'felt I myself again better' |
| | wanneer hij <i>komt</i> , weet ik niet | 'when he comes, know I not' |

It was hypothesized that it is this particular kind of input that causes adult learners of Dutch to produce utterances with verb-third. Given that complementizers such as *toen* 'while' and *wanneer* 'when/if' have temporal meaning, verb-third order may be expected to occur in main clauses

particularly with temporal adverbs. L2 learners of Dutch showed that this indeed seems to be the case. Spontaneous production data from four ESF informants provided evidence that in utterances with verb third, the topic position before the subject was typically taken by a time adverb such as *dan* 'then', *eerst* 'firstly', *dinsdag* 'Tuesday', *morgen* 'tomorrow', *toen* 'then', *volgend dag* 'next day' and *wanneer* 'when'.

Jolink started her dissertation project on the acquisition of the structural and functional properties of finiteness in Dutch. Starting point for this project is Dimroth and Jordens's study on patterns in first and second language acquisition (Annual Report 2001 and above). Findings from their study indicate that the acquisition of the structural and functional properties of finiteness proceeds in three consecutive stages, referred to as: the "holistic stage", the "conceptual ordering stage" and the "finite linking stage". The functional properties of finiteness – linking and temporal anchoring – are expressed to a different extent and by different means throughout these acquisitional stages.

In order to explore the developmental stages in the acquisition of finiteness in more detail, a longitudinal case study was started with 6 normally developing (ND) Dutch-learning children and 2 children with Specific Language Impairment (SLI). Biweekly recordings were made of spontaneous and elicited speech, from age 1;8 – 2;0 (ND) and 4;3 (SLI) on.

Preliminary analysis of the obtained data suggests that, even though the SLI children are ahead of the ND children in their pragmatic and lexical skills, their advantage in grammatical development over the younger ND subjects is less apparent. Although the SLI children's percentage of verb-containing utterances is three times as high as that of the ND children, their percentage of nonfinite verb-containing structures is three to six times as high. The ND subjects have reached the holistic stage, and two of them have now passed on to the conceptual ordering stage, in which linking and anchoring are established lexically, by means of protomodal elements. The SLI subjects also appear to have reached this second stage: in spite of the fact that they are older and already use a variety of verbs and constructions, they do not yet use the grammatical devices for linking and anchoring that are characteristic of the finite linking stage.

Kirsch joined the Finiteness Project in May and started a corpus analysis on lexically empty and full verbs in Russian and German first language

acquisition. Russian and German belong to different language types with regard to some lexically empty verbs. One type is known to have a copula in both equational and existential sentences, while the other does not have a copula in equational sentences (Ferguson 1971). Typically, languages of the second kind have a different verb or verb equivalent for existential clauses. For possessive constructions Russian, a language of the second type, uses an existential locative construction, whereas German (like English and Dutch a language of the first type) uses the verb *haben* 'have'.

Kirsch investigates whether the crucial role of "protomodals" and auxiliaries that previous research has found in the acquisition of finiteness as a grammatical category in Germanic languages (see Annual Report 2001 and above) can be observed in the acquisition of a typologically different language. Her exploratory analysis of the development of one Russian and one German child in the relevant period at the 3-to-5-word stage suggests that these children display different patterns in the acquisition of finiteness. The analysis of the German child Caroline supports previous research within the project by showing that Caroline uses protomodals in combination with root infinitive prior to morphological inflection on lexically full verbs. The corpus data of the Russian child Anja suggest a different pattern. Here morphological inflection on lexical verbs comes into play from the beginning of the 3-to-5-word stage. Future research has to validate these hypotheses and to describe the acquisition of lexically empty and full verbs in more detail and on a broadened data basis.

10.3 Expression of simultaneity

Gretsch and Schmiedtová examined young children's understanding of the basic temporal concepts "sequentiality" and "simultaneity". This research was motivated by Schmiedtová's finding that second-language learners encounter significant difficulties when attempting to express temporal simultaneity in the target language (Annual Report, 2001). Gretsch and Schmiedtová's study was guided by two questions: (a) which concept – simultaneity or sequentiality – is understood by children first; and (b) which concept of the two is linguistically easier to express.

A main point of the experimental design was to separate a cognitive from a linguistic task. An elicited production task was administered to 50 German speaking children between the ages 3;1 – 7;8. Six temporal relations were depicted by video clips showing two prototypical lamps turning on and off

in different temporal order (cf. figure 10.3). The variables order and color of the lamps were controlled.

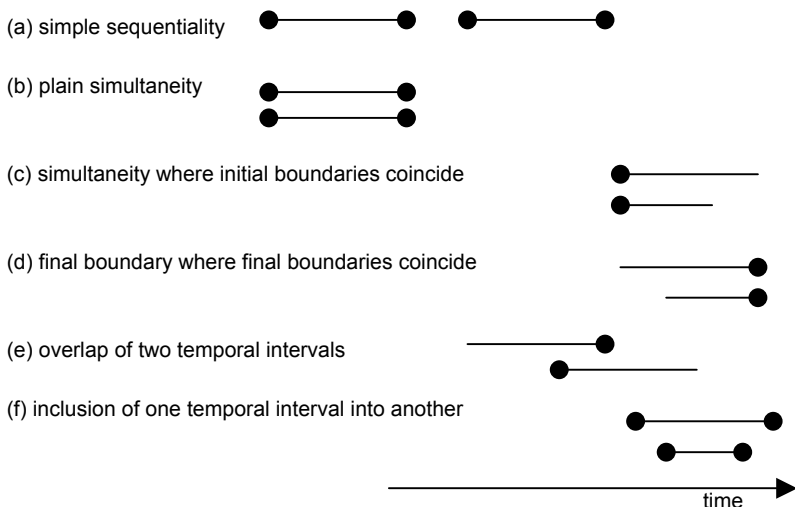


Figure 10.3: Relative ordering of on/off states of the lamps

To address question (a), the children were asked to act out the temporal relation they saw in the movie with the aid of the same set of lamps as used in the stimulus. These lamps were actually standing in front of them. A second step then targeted question (b): the children described the scene in their own words.

A test of chi-square (χ^2 (3, N=50) > 3.841, $p < .05$) revealed the following: "plain simultaneity" was correctly acted out and correctly verbalized by all children significantly more often than any other tested temporal relation. Therefore, plain simultaneity is cognitively as well as linguistically the most basic concept in development (even in comparison to simple sequentiality). This also holds for the youngest group (3 and 4 year olds).

This result suggests that "plain simultaneity" of two events is interpreted as one event and therefore loses its apparent complexity. What is a difficult task for children is to order two individual events in time into one coherent, complex event. Moreover, the number of transitions (in this study 2 to 4 changes of states) is the decisive factor for the order of acquisition. In this manner, the ordering of events along the horizontal axis is more difficult than their linking in vertical direction. In order to depict this difference, compare the following two figures:

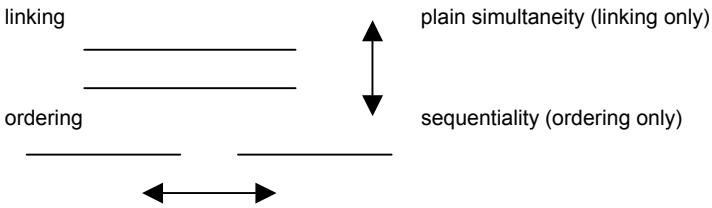


Figure 10.4: Linking vs. ordering of temporal intervals

In the language task, children perform better when presented with the relation of "plain simultaneity" than when they had to describe "simple sequentiality". All the other items representing simultaneity were more difficult to express than the condition of "simple sequentiality". It is commonly assumed that since language is inherently sequential, sequentiality is easier to encode in language than any other time relation, and thus the default (cf. Fraisse 1963, Clark/Clark 1968, Feagans 1979). Gretsch and Schmiedtová's findings challenge this assumption.

The experimental design, as described above, produced two cases of apparent mismatches between the stimuli and their linguistic and cognitive representations: (i) children incorrectly act out the temporal relation from the stimulus; however, they describe it correctly in the linguistic task; (ii) the acting out part corresponds to the children's verbal description but neither depicts the presented stimulus. Case (i) was produced by 24 out of 50 children, whereas case (ii) occurred in 38 out of 50 children. Both cases can be found across all tested items.

These unexpected responses can be interpreted in the following way: Case (i), the incorrect acting out, indicates a successful linguistic performance without the generally assumed cognitive prerequisites (i.e. the opposite is implied: a stimulus-adequate acting out is followed by a correct linguistic representation of the stimulus). Case (ii) implies that children are able to uncouple the stimulus from the performance in both tasks.

The existence of these atypical responses shows that children are capable of different strategies when dealing with this complex task. Case (ii) suggests that children allow for an avoidance strategy, whereas case (i) directly confronts the claim that cognitive skills are necessary prerequisites for linguistic abilities. In other words, children are saying something that they themselves do not (yet) understand. In line with this claim, Gretsch

and Schmiedtová propose a speaking (be)for(e) thinking hypothesis as a complementary way of understanding the developmental interplay between cognition and language (cf. Slobin 1996).

11 THE DYNAMICS OF LEARNER VARIETIES

This project differs from other Institute projects in that only a small fraction of the actual work is done at the Institute itself. Its role is rather to coordinate the joint research of a group of European research institutions, in particular the universities of Amsterdam (VU), Bergamo, Berlin (Free U. and Humboldt U.), Cambridge, Heidelberg, Paris (U. III, U. VIII, and U. X), Pavia and Nijmegen. Since its beginning the project has been concerned with the comparative analysis of untutored adult language acquisition from a crosslinguistic and longitudinal perspective. Its research is in many ways based on work done in the European Science Foundation's (ESF) project Second Language Acquisition by Adult Immigrants (Perdue 1993) and some other contemporary projects with a closely related setup.

Researchers follow an approach in which the process of second language acquisition is not characterized in terms of errors and deviations, but in terms of the two-fold systematicity which it exhibits: The inherent systematicity of a learner variety at a given time, and the way in which such a learner variety evolves into another one. An underlying assumption is that development in the direction of the morphosyntactic specifics of the target language takes place when the available linguistic means do not allow the learners to cope with certain discourse contexts. For instance, finiteness marking on the verb, and hence grammatical agreement, tense and aspect emerge when the learner wants to express that "topic time" and "situation time" (Klein 1994) do not coincide (see Starren, Annual Report 2001), or that the inherent temporal properties of an utterance are at variance with its intended temporal relationship to other utterances in the discourse (see Noyau, Annual Report 2001). Focalization or topicalization devices emerge where the information structure of

utterances in the "basic variety", (Klein & Perdue 1997, see Annual Reports 2000 and 2001) is at variance with the discourse-dependent informational status of some utterance component (see Murcia-Serra, Annual Report 2000), or with the intended scope of some operator, e.g., negation (see Becker, Annual Report 2001). In 2002, these assumptions continued to determine the choice of the main research topics pursued by the individual teams: the expression of finiteness and temporality, the acquisition of scopal items (focus particles, negation), the construction of complex discourse, and the interrelation of these properties. The successful integration of scope particles and temporal adverbials, for example, was shown to depend partly on the acquisition of finiteness and certain temporal features (see Benazzo and Dimroth, Annual Report 2000).

New types of naturalistic and experimental data collections have been added to the large corpus of the ESF project. These more recent data sets aim at a close comparison between the construction of discourse in first (L1) and second (L2) languages (U. Paris VIII, see Chapter 11.1), the study of untutored L2 acquisition in children (DaZ-AF project, MPI and U. Köln, see Chapter 11.1 and 11.2), the study of discourse construction in very advanced second-language learners project (U. Heidelberg, see 11.2), and a cross-linguistic analysis of the L2 acquisition of the expression of selected temporal features (Schmiedtová, see Chapter 11.2).

Together with the ESF database these new data collections offer the possibility to address two domains of inquiry that are crucial for a better understanding of the human language-learning faculty, namely the long-standing questions (a) how first-language acquisition differs from second language acquisition (see Chapter 11.1), and (b) how second-language acquisition in children differs from second-language acquisition in adults (more specifically: whether adult learners can ever reach an end state that is comparable to the nativelike outcomes that are typically assumed for younger learners (see Chapter 11.2). The common assumption is that first and second language acquisition differ greatly with respect to learners' developmental path as well as with respect to the state at which the developmental process typically comes to a halt. The results summarized in the following reports suggest a more complex picture. First and second language learners can be shown to produce amazingly similar structures even though this might be for different reasons (Benazzo et al.). With respect to the speed of their progress in certain domains, young second language learners can even outperform first-language learners (Dimroth).

Under favorable conditions, late second-language learners can attain nativelike outcomes across multiple linguistic tasks (Birdsong), though deep-rooted differences in the conceptualization of temporal or spatial features in the speakers' source and target languages may result in serious problems for the construction of coherent discourse even at a very advanced level of acquisition (Carroll and von Stutterheim). Source language influence has therefore to be taken into account (Schmiedtová).

The work of Birdsong, Dimroth, and Schmiedtová was done at the Institute itself. The work of Benazzo, Carroll, Perdue, von Stutterheim and Watorek was carried out at other institutions.

11.1 Similarities and differences between first- and second-language development

In their project entitled *Construction du Discours par des Apprenants des Langues, Enfants et Adults*, Benazzo (U. Lille), Perdue and Watorek (both U. Paris VIII) examined learners' use of additive particles and temporal adverbs when producing narrations from a story book and descriptions from a poster depicting a street scene. The particles examined were *aussi* 'also', *encore* 'again/still', and *toujours* 'still/always'. Subjects were groups of L1-French-learning children aged 4, 7, and 10 years and a group of adult Polish learners of L2 French.

Although the 4-year-olds and adult beginners produce very elementary utterances with similar utterance patterns, the differences in the organization behind these patterns are striking. The adults' reference to protagonists relies on minimal means but is functional (example 1) whereas the 4-year-olds often denote the relevant entities with deictically used, referentially ambiguous pronouns (as in (2), where the pronoun *il* 'he' refers to two different entities).

(1) French L2:

monsieur rouge partir // monsieur bleu aussi partir
'mister red leave // mister blue too leave'

(2) Native French, 4 years old:

le monsieur il s'en va // il s'en va aussi
'he leaves // he leaves too'

There are also remarkable differences in the domains of space and time. Even beginning adult learners locate entities in space for the description, whereas 4-year-olds use the poster as an implicit relatum for the themes, which are simply enumerated (cf. (3)):

(3) Native French, 4 years old:

une voiture // un trottoir // et aussi des oiseaux
'a car // a sidewalk // and also birds'

The time line in the 4-year-olds' retellings is nonexistent. In these circumstances, the particles have considerable structuring power: for example, *aussi* functions to link a similar referent type (theme or process; cf. (4)) to two different situational contexts – *là aussi* ('there too').

(4) Native French, 4 years old:

(a) et puis là il y a trois fenêtres // *ici* aussi et *là* aussi
'and then there are three windows // here too and there too'
(b) là il est allongé // *là* aussi
'there he's lying down // there too'

The young children's use of additive particles creates links between the themes or the processes, but *not* via the discourse context. Children progressively come to structure the spatio-temporal context, first into discrete subspaces, encoding a preponderant topological relation of inclusion in descriptive text, and in the retelling, a temporal chronology. On the discourse level, this is "basic variety" conceptualization, which both children and beginning adults show. But children have to get there. Hereafter, the discrete relations between spatio-temporal contexts can be supplemented by "continuity": first, indirectly, in the domain of time, by use of adverbs (*encore*, *toujours*, as in (5)) that extend the time of situation (see Chapter 10); and only later in the domain of space (as in (6)).

(5) Native French, 7 years old:

après il s'endort // et puis il est toujours en train de dormir
'then he falls asleep // and then he still is sleeping'

(6) Native French, 10 years old:

à droite de la fontaine il y a un banc // encore plus bas il y a un monsieur
'on the right of the fountain there's a bench // still further down there's a man'

In sum, the adults use their already developed capacity to organize information across utterances right from the beginning, immediately using the additive particles to encode discourse-anaphoric relations. The children, however, first have to master the anaphoric relations themselves. Additive particles are used first to link extralinguistic referents, in very narrow contexts, and it is only with the developing capacity to use language as a context for language (Hickmann 2003) that true anaphoric use is acquired. Anaphoric use of the particles thus develops with children in parallel with that of other morphosyntactic devices to fulfil similar

discourse functions – those devices that adults often does without. Dimroth and Jordens (VU Amsterdam) continued joint work on the role of finiteness in first- and second-language acquisition. Results are presented under the chapter on the Finiteness Project (see Chapter 10.2).

In collaboration with Haberzettl (U. Potsdam), Dimroth compared the acquisition of verbal inflection in German by a group of child second-language learners to the acquisition of the same phenomena in first-language learners (based on the Wegener corpus and the corpus collected in the DFG project conducted by Dimroth and Stephany (U. Köln), see Annual Report 2001 and Chapter 11.2).

Longitudinal production data of three 6-8-year-old untutored Russian learners of German reveal that these L2 learners proceed faster than monolingual children acquiring German as their mother tongue. Table 1 shows the acquisition of subject-verb agreement from the onset of observation in the third week after arrival up to the 12th week of target language (TL) contact for one of the L2 subjects (age 8). Whenever the learner used the wrong inflection (*) in some context, this is specified in a second line.

WEEK OF TL CONTACT	1 SG -E	3 SG -T	1 PL -EN	3 PL -EN	2 SG -ST
3	9/12 1/1 -en*	4/5	1/1	1/1	
4	2/3	2/3 1/1 -e*			
5	1/1	1/1		1/1	1/1
6	5/10 1/1 -t*	2/3 2/2 -en*			3/6
7		1/1	1/1		2/2
8	7/9 1/1 -t*	9/15 4/5-en* 1/1 -Ø*	3/6	2/2	
9	4/20	6/21 1/1-en* 1/1 -e*	5/15		8/20
10	10/17	10/18	3/5		4/10
11	5/19	12/33 1/1-e* 2/2 -Ø*	4/14 1/1 -e*	1/1 1/3 -t*	
12	8/23	11/17	5/25		2/6

Table 11.1: Subject-verb agreement of lexical verb forms (lemmas/tokens) in Nastja (age 8)

From very early on some verbs (*malen* 'to draw', *spielen* 'to play', *kaufen* 'to buy', *haben* 'to have' in weeks 3 and 4) are adequately used in two or three morphological forms. Subject-verb agreement is 100% correct from the 12th week onwards. Despite the fact that the observed L2 learners, who continued to speak their L1 Russian at home, had less target language input than young monolingual children, there is clear evidence that the latter group needs more time between the onset of language production and a productive and error-free marking of subject-verb agreement (Clahsen 1986, Mills 1985).

Early L1 learners have been shown to collect a stock of linguistic material and to use it more or less unaltered (Tomasello's usage-based theory of language acquisition). This leads to item-based schemas with growing variation occurring in certain slots, and it is by opening more slots and thus by stepwise modification of the schema that L1 learners finally arrive at the abstraction of linguistic rules.

In the child L2 data Dimroth and Haberzettl found many instances of ready-made and consequently correct utterances that the learners mapped onto all sorts of communicative situations instead of taking the risk of "homemade" adjustments:

(7) Eugen (age 7):

E: Ich weiß nicht wie das geht

'I don't know how this works'

(meaning: I don't know what his name is)

If child L1 and L2 learners follow a largely input-driven and pattern-oriented strategy, it is to be expected that the sample size needed in order to leave the utterance or chunk level and enter the realm of symbolic rules is reached faster by the L2 learners, as observed by Dimroth and Haberzettl. L2 learners are experienced language learners and thus trained to pay attention to formal contrasts, knowing that these might be functional. Moreover their greater cognitive maturity helps them to tackle form-function mappings involving, for example, the expression of complex temporal or spatial relations.

11.2 Levels of attainment in second-language acquisition

Dimroth continued to study age-related differences in untutored second language acquisition. Production data from a longitudinal case study (DFG

project, Der Altersfaktor im Erwerb des Deutschen als Zweitsprache (DaZ-AF)) on the acquisition of L2 German by two Russian subjects (aged 8 and 14) confirmed the well-established fact that older learners are generally less successful in second-language acquisition than younger children, who often attain nativelike end states. Instead of focusing on ultimate attainment, Dimroth studied the process of language acquisition by establishing developmental sequences in selected areas of target-language morphosyntax and by comparing the time course of their acquisition in the two subjects. Selected target-language properties from the domain of verbal morphology were subject-verb agreement, the construction of the *perfekt* with the auxiliaries *haben* 'have' and *sein* 'be', and the preterit.

After six months of target-language contact all of these were used productively by the younger learner and were as well both formally and functionally adequate.

Despite a higher overall error rate in the older learner, her development looks quite similar for the present tense and the *perfekt* with the more frequent and unambiguous auxiliary *haben* 'have'. In contrast, the *perfekt* constructed with *sein* 'be' and the preterit of lexical verbs do not become productive during the first year of target-language contact. Given that for most verbs, the *perfekt* is the preferred form for past-time reference in colloquial German, and that an overuse of the auxiliary *haben* does not lead to misunderstandings, neither of the constructions disregarded by the older learner are of great additional communicative value in everyday communicative contexts. The possible explanation that the older learner is more sensitive to the communicative payoff of target language properties, whereas a selection along these lines is no option for the more form-oriented younger learner, needs further investigation in other areas of target-language grammar.

In collaboration with Klein, Dimroth, and Bast (U. Köln), Birdsong (U. Texas) examined transcripts of elicited and naturalistic L2 German speech from the same corpus (DFG project DaZ-AF). Specific features analyzed included number, natural and grammatical gender, and case marking in nominals, pronominals, demonstratives and possessives. Models of maturational constraints on L2 acquisition would predict certain acquisitional advantages for the younger learner. However the analyses did not yield consistent evidence for such age-related differences.

Attitudinal and circumstantial variables appear to account for many of the interlearner differences in production data.

In the project *Advanced Learner Languages from a Crosslinguistic Perspective*, Carroll, von Stutterheim and colleagues studied language-specific effects in the selection and structuring of information in advanced learner languages. Their crosslinguistic analyses addressed the difficulties that arise in reaching nativelike proficiency when structuring the semantic domains of time, events, space, entities, etc. in L2 discourse. Many factors that distinguish very advanced learners from native speakers could be ascribed to the way in which grammaticized categories relate to patterns of information organization in the learners' L1 linguistic systems.

A comparison of film retellings by native speakers of English and German revealed significant crosslinguistic differences in the events selected for mention and the perspective taken in temporal frames of reference: German speakers present events holistically (i.e., events are represented as bounded and thus include an endpoint), while English speakers tend to decompose events into different phases, preferring a temporal perspective that incorporates ongoing, unbounded events. In line with current work on grammaticization (cf. Traugott & Heine 1991, Hopper 1995) it is assumed that grammaticized conceptual categories play a predominant role in determining the way in which conceptual material is organized for expression. English and German differ with respect to the grammaticization of aspectual distinctions, since English codes the concept of "ongoingness" morphologically on the verb while German does not. This structural feature [+/- aspect] induces preferred patterns of event construal in temporal frames of reference.

Based on these findings a series of follow-up studies was carried out in order to test whether the observed contrasts hold only at the level of the macrostructural organization of texts, or whether they are also evident in the verbalization of isolated events in decontextualized situations. In most of the depicted situations the initial and intermediate phases of the event were focused and the endpoint was not shown but could be inferred (e.g., *someone is digging around in the sand; someone is digging a hole*). The results showed that German and Norwegian speakers tend to construe a possible endpoint, while speakers of Arabic, English, and Spanish are unlikely to do so. These findings were tested further by measuring the speech onset times for the same data – the assumption being that if German speakers need an endpoint in order to provide the conceptual

correlate of what can be coded as an event, they will wait for an event to become evident as a whole before starting to speak. In contrast, speakers of Arabic, English and Spanish can describe any phase of an event in its own right and do not have to wait for the result of an action. In sum, significant differences between German, English and Spanish speakers were found with respect to situations where an endpoint cannot be easily inferred. The results thus confirm what was found in the analyses of the verbal tasks: in providing the basis for a reportable event German speakers show a clear preference for a holistic perspective. In contrast, a situation such as *someone is digging* constitutes a reportable event for speakers of languages that mark the relevant aspectual distinctions (von Stutterheim in press).

In a parallel series of L2 studies Carroll, Lambert, von Stutterheim and colleagues investigated the extent to which very advanced learners implement the principles of information organization that grammaticized concepts entail in the target language. An analysis of narrative texts produced by very advanced L2 learners of English (with L1 French or German) revealed that learners transfer patterns of information organization from their native languages at the level of macrostructure, and information organization in L2 does not conform with the principles followed by native speakers in a number of critical aspects (Carroll & Lambert 2003).

In the construal of events in isolated situations the results reveal that L1 principles are still active when conceptualizing what is considered to be a reportable event. Although German learners of English were shown to have acquired the native English pattern to a certain degree (emergence of the target language pattern was observed in that endpoints were not mentioned when they could be inferred, or when the focus was on ongoingness), the learners still construed a possible endpoint in cases where it could not be inferred (corresponding to principles in the learners' L1). In contrast, English learners of German did not acquire the holistic perspective required in German; those cases in which endpoints were marked corresponded to the ones where marking is also found in the L1 (von Stutterheim in press).

These differences may be linked to the fact that in English there is a salient grammatical form that encodes the specific concept "ongoing"; by acquiring this form the learner is directed to the function it serves. For the learner of German there is no device that codes the concept "holistic". The

speaker has to identify expressive means associated with this concept and the function it serves at text level through inference from different informational components.

Schmiedtová continued her dissertation project on the acquisition of temporal expressions of simultaneity in a second language. She investigated in detail how adult English and German learners of Czech describe temporal simultaneity in narrative discourse. As mentioned previously (Annual Report 2001), overtly expressed simultaneity in spontaneous discourse is rather rare. Data were therefore elicited by a set of commercials where simultaneity was essential to the plot of the story. Schmiedtová found various differences with respect to: (i) how learners linguistically express simultaneity in their respective source and target languages; (ii) the way learners deal with the complex system of grammatical aspect in Czech.

(i) To encode simultaneity, Czech and English native speakers employ aspectual contrast either alone (juxtaposition of perfective and imperfective forms (example (8)), or by combination of two imperfectives (9)0000, or in combination with temporal adverbials (such as *while* (10)).

- (8) tak on to slízává (imperfective), někdo otevře (perfective) dveře
'so he is licking it off, somebody opens the door'
- (9) and there is a man sitting on a couch and there are men repairing the couch
- (10) he goes to lick off the ketchup, and the mustard (...) and while he is doing this, his brother walks into the room

In addition, they also make use of inchoative verbs (such as *to begin*) for the same purpose. German native speakers, on the other hand, exclusively use adverbials or adverbial phrases for encoding temporal simultaneity. This pattern becomes even stronger when looking at Czech as a second language. From early on, English learners make use of the pure aspectual opposition significantly more frequently than German learners do and even significantly more often than Czech native speakers. German learners, on the other hand, cling to the familiar adverbial way and only meet the challenge of exploiting the means of aspect for expressing simultaneity at a more advanced level of proficiency. These results suggest that the options for encoding offered by the source language make learners choose corresponding options in the target language.

(ii) Striking differences can also be noticed with respect to the way English and German learners understand and apply the aspectual system of Czech. The basic aspectual opposition in Czech is between perfectivity and imperfectivity. The latter is expressed by means of suffixation (suffix *-va*). In contrast, perfectivity is encoded either by suffixation (*-nou*) or by prefixation, twenty different prefixes that mostly modify not only the aspectual but also lexical properties of the verb. In the native Czech data set, there is no significant difference between the number of imperfectively and perfectly marked verb forms. In the English data, imperfectively and perfectly marked verb forms are equally represented as well. However, German learners use significantly more perfective forms than English learners and Czech natives. When encoding perfectivity in Czech, German learners prefer to use prefixes over suffixes. These results suggest that German learners of Czech focus on prefixes expressing aspectual and lexical modification of the verb, while English learners prefer to pay attention to the aspectual opposition between perfective and imperfective. This sensitivity can again be motivated by the linguistic devices of the corresponding source languages: English learners of Czech use imperfectives mainly because English has a fully grammatical marked form for the expression of the imperfective aspect – the *-ing* form.

12 OTHER RESEARCH

12.1 The online archive for documenting data of (endangered) languages and cultures

Any archive documenting linguistic material is useful only to the extent that the available data satisfy the needs, demands and standards of its users. An archive documenting material on (endangered cultures and) languages is of interest for many parties. This imposes high demands on how the linguistic data are presented in the archive, how they are annotated, and how they are made available to the users. Among the users of such an archive are certainly not only scientists working in the various subdisciplines of linguistics, anthropology and other social and cognitive sciences, but also members of the speech communities whose language and culture is documented there. Moreover, the archived data should also be useful for future generations and their potential interests in the materials. In connection with the DOBES project, sponsored by the Volkswagen Stiftung, Senft – in cooperation with Wittenburg, Broeder, Brugman and Skiba – compiled a number of questions to crucial for the design of such an archive. These questions deal with the above mentioned issues, especially:

- with the structure of an archive that can provide users with quick, effective and useful information with respect to their (research) interests;
- with the energy and time contributors to such an archive have to invest to document a language as adequately as possible;
- with aspects of language documentation that may be of interest for future generations;

- with ethical problems with respect to language documentation, and with issues of intellectual property rights.

These questions were presented and discussed during the LREC preconference workshop on "Resources and Tools in Field Linguistics" in May in Las Palmas (see: <<http://www.mpi.nl/lrec>>). The results will be taken into account by the Technical Group in continuing to develop the language data archive at the Institute.

12.2 The semantics of quantifiers in natural languages

Seuren's research has been a continuation of the enquiry into the logic of language and thinking, which started in 2001. It has now spread to a much wider scope investigation of the relations between logic and natural language. So far it looks as if language has a preference for a maximization of the logical potential of logical constants (i.e., quantifiers and propositional connectives), which define a logical system. In terms of entailment potential, the logical constants of natural language, which conform to the traditional logical systems of Aristotle and the Stoa, are much richer than those of modern standard logic.

This is particularly evident in the quantifying operators *all* and *some*, which are fully Aristotelian in natural language, in the sense that the universal quantifier *all* (as well as its close relatives) has (a) a corresponding existential entailment (cf. (1)) and (b) a presupposition of existence for the term quantified over (cf. (2)):

- (1) All cars are properly parked => At least one car is properly parked.
- (2) All cars are properly parked => There is at least one car.

Both entailments are not valid in standard modern logic, yet they make for an enormous increase in logical power. Standard mathematically based predicate logic has an extremely limited logical power compared to the old Aristotelian system of predicate logic. The logical power of the Aristotelian system is optimal in that it is representable as a complete hexagonal graph, in contrast to modern standard predicate calculus, which is seen to be markedly impoverished:

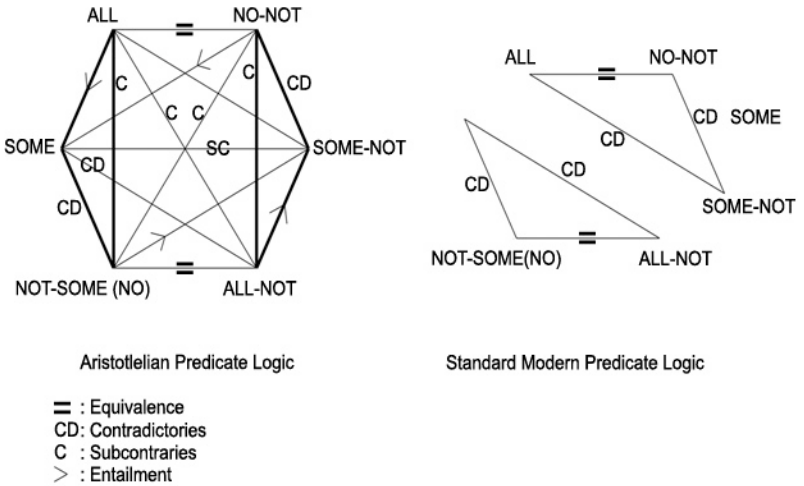


Figure 12.1: The logical power of Aristotleian vs. Standard Modern Predicate Logic

Yet the Aristotleian system is logically faulty in that it lacks a provision for those cases where the class quantified over is empty. This is now remedied by presuppositional logic (developed by the author), which is added to the Aristotleian system. Natural language has found an ingenious way of repairing the faulty Aristotleian logic by adapting the logic to the requirements of contextual binding, i.e. by a system of presuppositional entailments (an aspect totally neglected in standard logic). The logic of language thus appears to achieve the impossible: it optimizes logical power (as in the Aristotleian system) while keeping the logic sound (as in standard modern logic). Moreover, the presuppositional format ensures that the full logical power is reserved for those situations that are common in practical life, and the reporting of which is maximally informative, pushing back more marginal situations involving the null set or the total set of individuals in the model to a secondary nondefault level. It thus looks as if language has managed to minimize the deviations from standard mathematically based logic, while maximizing the profit in terms of logical power and practical relevance. If successful, the project will lead to a basic reorientation in pragmatics. The research continues, and a book is in the making.

12.3 Comprehension in discourse

12.3.1 Semantic/pragmatic and syntactic integration processes

In earlier research on relative clause processing (see Annual Report 2000: 122-124) it was found that when there is a syntactic subject-object ambiguity in a relative clause, the reader's choice of the subject is influenced by agency and topichood. In a follow-up study, Vonk and Mak (U. Nijmegen) investigated whether this tendency is also found in sentences that do not contain ambiguities. Earlier research showed that a sentence is easier to process when it has the same subject as the previous sentence, as, for example, in (3a) versus (4b).

- (3) John invited Mary for a tennis match.
(a) He beat her in three sets.
(b) She beat him in three sets.

This phenomenon has been explained by a "parallel function strategy" in which the reader prefers the same syntactic subject to be maintained throughout consecutive sentences. Note, however, that in (3a) not only the syntactic subject but also the agent of the two sentences is held constant. The effect may therefore also be the result of a "parallel agency strategy". This was tested in sentence pairs in which the first sentence was passive, as in (4).

- (4) John was invited by Mary for a tennis match.
(a) He beat her in three sets.
(b) She beat him in three sets.

In these sentence pairs, a parallel function strategy would again lead to a preference for (4a) over (4b), but a parallel agency strategy would lead to the opposite result. In self-paced reading experiments faster reading times were found in (3a) than in (3b), whereas faster reading times were obtained in (4b) than in (4a). This can best be explained by a preference of the reader to maintain the same agent throughout consecutive sentences. Vonk also continued a project on the processing of syntactically ambiguous coordinations in collaboration with Kerkhofs and Schriefers (both U. Nijmegen). The question is whether and when nonsyntactic factors such as topichood affect the syntactic disambiguation. Earlier research was conducted in the visual modality. The central question now is to which extent prosody and context factors can affect the disambiguation. The syntactic ambiguity consisted of a conjoined-NP vs. an S-conjunction reading (e.g., *De sheriff zag de cowboy en de indiaan . . .* 'The sheriff saw the cowboy and the indian...' which can continue in *saamen*

aan de bar zitten 'sitting together at the bar.' or in *sprong op zijn paard* 'jumped on his horse.').

Since the methodology to be used in the auditory modality was the measurement of event-related brain potentials (ERPs), first an experiment in the visual modality was conducted with this method. In this experiment a total of 30 subjects were tested, with a testing time of three and a half to four hours per subject. The stimuli were presented centrally on a computer screen in a machine-paced mode. The effect of ambiguity was measured by comparing S-coordination sentences that were disambiguated by a comma with their ambiguous counterparts. A significant effect of ambiguity was found at the disambiguating verb (*sprong*) as reflected by a negative peak followed by a positive shift for the ambiguous relative to the unambiguous sentences. These results show – confirming earlier eye movement studies (cf. Annual Report 1998:104) – that in the absence of biasing information a preference exists to interpret the ambiguous string (*de cowboy en de indiaan*) as a conjoined NP.

In a second experiment the materials from the first experiment were presented in the auditory modality. A total of 32 subjects were tested, with a testing time of two and a half to three hours. ERPs to the disambiguating verb were compared in S-coordination sentences with either an S-coordination intonation or an NP-coordination intonation in the ambiguous string. A significant increase in positivity was found after the disambiguating verb following the NP-coordination intonation as compared to the S-coordination intonation. This result showed either an NP-coordination preference in the absence of an S-coordination cue or the effectiveness of the NP-intonation.

A third experiment, in which the auditory materials from the second experiment are embedded in a context of four to five sentences, is underway. These contexts are designed either to bias towards the S-coordination resolution by manipulating the topichood of the coordinated object of the target sentence, or to be completely neutral with respect to the resolution of the ambiguity. This experiment will be conducted to see whether the NP-coordination preference observed in isolation still holds in an S-coordination biasing context.

12.3.2 Inference processes

Vonk, together with Frank, Koppen (both U. Nijmegen) and Noordman (Tilburg U.), continued a project in which a computational model is being

developed to simulate knowledge-based inference processes in the comprehension of stories. A story is considered a description of consecutive situations within a relevant knowledge domain. A situation is distributively represented as values of cells that form a self-organizing map (SOM). The organization of the SOM is acquired on the basis of a large number of realistic example situations presented to it. As a result, the SOM represents world knowledge about nontemporal relations between propositions within the domain of the story. Knowledge about temporal contingencies between propositions is also based on a sequence of realistic example situations, and stored distributively in a matrix that relates the cells of the SOM to each other. Comprehending a story is thus the process in which the reader constructs the narrative situations from the distributed representation based on the sentences in the text. In terms of propositions this implies that the comprehender constructs a representation of the propositions that are given in the text and estimates the likelihood of propositions that are not given in the text. The latter are inferences. The model was shown to correctly infer propositions that are likely to be the case in the story, and results were in accordance with empirical data concerning reading times and story retention.

The model was further refined and extended to include a parameter modeling the reader's depth of processing. Results showed that both processing time and amount of inference increased when the depth of processing was increased. Moreover, deeper processing led to better story retention. Also, the model was extended to simulate knowledge-based pronoun resolution. It was noted that ambiguous pronouns were inferred to refer to the entity that was implied by context information to be the correct referent. Foregrounding could overrule this effect. Moreover, processing times were longer if the foregrounded entity was not the logically correct referent, compared to cases in which foregrounding and contextual information were consistent.

13 TECHNICAL GROUP

Once again the Technical Group is able to report a very successful year: its efforts in developing technologies for corpus creation, archiving, management and exploitation resulted in three members of the group, Broeder, Brugman and Dirksmeyer, being honored with the Heinz Billing Award for Scientific Computing. The work on this technology was funded largely by external sources and was widely regarded as an excellent contribution to the field.

This year the TG took the opportunity of the international Language Resources and Evaluation Conference (LREC) to report its work in the area of metadata, corpus building, annotation tools, gesture analysis, lexicon analysis and audio archiving format analysis. Especially its activity in the creation and enlargement of the Documentation of Endangered Languages (DOBES) archive lead to a number of further invitations to various workshops and conferences.

All software developed by the TG is now available on the web site www.mpi.nl/tools and the download and launch operation has been simplified through the Web Start mechanism. The TG intends to offer more and more software under open-source licenses. Exactly which open-source license model it will be has yet to be determined. The Institute's policy still stands that all software remain free of charge for academic use.

13.1 Overview of externally funded TG projects

The EC-funded projects International Standards for Language Engineering (ISLE) (see www.mpi.nl/ISLE) and Multimedia Indexing and Search (MUMIS) (see parlevink.cs.utwente.nl/projects/mumis) came to a close at the end of 2002. The programming of the greater part of the Corpus of

Spoken Dutch under the Corpus Exploitation Tool (COREX) has been accomplished and DOBES has entered into its main project phase (see www.mpi.nl/DOBES). In addition, two new EC-funded projects were prepared and initiated: (1) The Integrated European (Language) Resource Area (INTERA) project, whose goal is the establishment of a metadata domain of language resources in Europe and (2) European Cultural Heritage Online (ECHO) (<http://echo.mpiwg-berlin.mpg.de>; <http://www.mpi.nl/echo>), a project whose aim is to facilitate online access to European cultural heritage. The Institute TG will play a leading role in the development of the technology and infrastructure of both projects.

The ISLE project concluded with a workshop in Nijmegen to discuss experience made with the present ISLE Metadata Initiative (IMDI) set and to plan subsequent versions of the IMDI set. The IMDI tools (IMDI BCEditor, IMDI BCBrowser, IMDI BDSearch, Scripts for efficient management) were delivered in nearly professional quality and will be maintained and extended in the INTERA and ECHO projects. The MUMIS project resulted in technology that allows searching on video streams and quickly presenting the corresponding video fragments. Together with leading European partners it was checked whether automatic processing of speech and textual material in different languages could be applied to create indexes. Also considered was how lexica and ontologies could be optimally integrated to guide the user submitting his query and how rich text information could be linked with the video fragments. Two versions of the user interface were delivered: (1) One version working on a local machine where all components are written in Java and (2) a version working in a typical web environment for which a Javascript-based thin client was programmed that interacts with a database containing annotations via a servlet process. For video presentation this version interacts with a Darwin video streamer requiring a Quicktime player on the client side.

In the COREX project the exploitation tool could be extended by a number of functions such as a viewer for syntax trees, as well as better integrated metadata and content search functions and a new statistics function panel.

In the DOBES project the pilot phase concluded successfully with the creation of a functional archive with considerable material contributed by the documentation teams. The size of the project was extended from 8 to 12 teams and all teams underwent a one-week training course. The metadata of the archive was made available on the web site. To make the

site more interesting for users, material without access restrictions was requested from participating teams. It was decided to establish an advisory board to manage the ethical aspects of the project. In further meetings the DOBES principles were explained to other groups of field researchers. A particularly productive meeting conducted with specialists from the "Electronic Metastructure for Endangered Languages Data" (E-Meld) project at Wayne State University and Eastern Michigan University resulted in agreements for joint activities for the coming year. In addition, a higher degree of data security has been assured through the decision to create a third copy of the DOBES archive to be housed at the Max Planck Institute for Evolutionary Anthropology in Leipzig.

13.2 Computer systems and networks

A complete personnel change in systems management required a phase of consolidation. This change was overcome without too much disruption and any significant decrease in the quality of service. However, some projects were postponed until next year to allow sufficient time for acquiring the necessary practical skills and on-the-job routine.

In addition, 2002 was dedicated to the organization of the entire Institute corpus so that various requirements could be met. For corpus management it is important to differentiate between metadata, which consists of open, highly unstable and preliminary data such as the Digital Master Files, which are to be decomposed into useful linguistic units, the final session files, and the associated text files such as annotations. Most of these files will be associated with Access Control Lists that define which of the users may access the corresponding files. For systems management purposes it is important to separate the different types of files, otherwise the implementation of the different archiving principles becomes unmanageable. For stable sessions files, for example, it is necessary to create immediately two copies, but to integrate them into the normal migration policy of the SAM-FS-based Hierarchical Storage Management system. For annotation files, which are comparatively small in terms of file size, it is useful to have one copy in the online cache of the HSM system.

All the many files from the different MPI projects distributed over many computers and disks had to be identified and systematically imported to the archive system. By the end of 2002 the MPI had achieved an almost completely integrated and organized corpus covering most of the available

resources. Almost all resources are accessible via metadata descriptions. To arrive at this stage several meetings involving the corpus managers, the tool developers and the systems managers were necessary, since many technical problems required a joint approach and high level of synchronization.

By the end of 2002 the AIT3 technology had been delivered, i.e. the capacity of the tapes increased from 50 GB (AIT2) to 100 GB (AIT3). All 6 tape drives were exchanged for drives able to read both AIT3 and AIT2 tapes, allowing the TG to transfer the whole corpus to the new media during the period of the Nijmegen lectures when most researchers are involved in attending the lectures, seminars and discussions, thus allowing the transfer to go almost completely unnoticed. The tape library now has a storage capacity of 15 TB, but could easily be extended by adding more tapes. It should be noted that the copying to AIT3 tapes revealed not a single read error, i.e. the whole HSM system appears to be very robust and reliable.

In 2003 our NT2 servers will be switched to Windows 2000 servers. During 2002 many tests were carried out with Active Directory and LDAP services to prepare for this major change and to make the transition for the users as seamless as possible. In addition, client machines will be upgraded to Win2000 , which will require an additional major time investment.

Another important activity in 2002 was to understand fully the principles of creating customized Microsoft Installer (MSI) packages. MSI packages allow the creation of an application program image for easy downloading to various Windows clients for local installation. Previously, this process was too time consuming and inflexible, in that a complete image was created of a particular software version twice a year and copied to CD-ROM. This was then used to install complete systems at local clients. Of course, such a procedure necessarily suffers from a certain inflexibility with respect to changes and updated versions, and reported errors could only be corrected months later. This inflexibility also required a significant amount of testing before launching such a master CD-ROM and repeated local adaptations to adjust to particular user requirements. With MSI packages it is possible for the user to install software himself or to automatically distribute application software versions to groups of users.

Concerning Macs, the Institute decided to move on to Mac OSX, since this would allow the users access to the new tools developed at the MPI.

However, preliminary tests with pilot users proved negative, since it turned out to be impossible to access files on UNIX file servers from Mac applications. This conflicted with the official documentation. For Mac OSX, it is also necessary to install the DAVE Samba client to access central files. This has now been tested sufficiently so as to allow users to make the changeover to Mac OSX.

13.3 Information systems

The external web site of the MPI acquired two additional entries: MPI Corpus and Tools. The tools site allows users to download the latest versions of a number of tools and the corresponding manuals via Web Start, the software launching tool from Sun. It guarantees that especially Java applications can be downloaded and installed even by the inexperienced user and can also be used as a simple shell for starting programs. The move to Web Start has simplified the dissemination of tools considerably, which was especially necessary for the DOBES project and for MPI users.

A speech-error database, including several contributions with speech errors, was made accessible on the Web. Here all speech-error records were delivered as normalized XML structures. Extensive tests were run to investigate to what extent the new Oracle 9i database version, which promises native XML support, could be used in the future for various purposes where XML-structured data play a role. The results were not encouraging, since it proved impossible to import the large set of error records. Therefore, the XML structures were transformed into a relational database design. The speech error database will be made available to the public during 2003.

Further, a complete web site for the management of the Conversational Multimodal Interaction with Computers (COMIC) project was created based on the POSTGRES database.

13.4 Linguistic applications

Experience gathered from use of IMDI set and possible new requirements resulting from the INTERA and ECHO projects were the main topics of a workshop attended by specialists from various European countries. Discussion focused on three essential aspects: (1) How to integrate written resources as they appear in language archives; (2) How to integrate

lexica; (3) How to describe the content of language resources. Proposals have already been presented for the first two topics, for establishing and maintaining a common core and special extensions allowing for the description of the specialties of the two types of resources (see www.mpi.nl/ISLE). While the lexicon subset was found to be acceptable for the most part, the set for written resources requires further discussion, which will take place within a subgroup formed at the workshop. Another subgroup was formed to discuss in more detail the content description portion. Among the elements describing the content, the most critical are "communication context" and "genre". In the version currently in use, version 2.5, both elements have subcategories. While the controlled vocabularies for "communication context" are small and fixed and therefore easy to handle, the experience of MPI researchers shows that the subcategories in "genre" are difficult if not impossible to handle. The degree of disagreement among the linguists involved implies the solution of simplification to one single main category "genre" with a large vocabulary that is not fixed. Version 3.x should be ready in March so that the IMDI tools can be adapted quickly and ready to be put into use soon.

The IMDI tools were extensively debugged and expanded over the course of the year. The IMDI editor now supports the saving of frequently used metadata chunks in special files, allows anonymization of sensitive data and the creation of corpus nodes. The IMDI browser has been extended by the introduction of a cache mechanism for increased speed and has integrated a metadata search facility.

In agreement with the designers of Open Language Archives Community (OLAC) an exchange of metadata records was implemented based on the OLAC-IMDI mapping proposal. It is now possible to search for IMDI records in the OLAC domain. The other direction must still be implemented. Since both the OLAC and IMDI metadata sets will soon be updated, a new mapping scheme must be worked out and the harvesting scripts adapted accordingly. This remains to be done in 2003.

A preliminary Universal Description, Discovery and Integration (UDDI)-based web service was implemented together with Dalli (Sheffield U.). A UDDI description and registration allows the user to search for controlled vocabularies for metadata. This service, based on Web Services Description Language (WSDL) and Simple Object Access Protocol (SOAP), returns the URLs of the vocabularies so that a service can make use of them in any required fashion. This method appears to be very

promising for the future when offering XML-based resources to the outside world.

The European Distributed Corpora Project (EUDICO) tool set was extensively debugged as well and a number of new features added. A revised and adapted version of ELAN (V1.2) was created and distributed. Its main objective was to allow the importing and exporting of Shoebox files and to support interlinearized annotations. In version 1.2 it is now possible to import and export Shoebox interlinearized annotations, to create manually such formats with ease and to visualize them. Visualization in ELAN always means that all viewers are synchronized with sound or video files if they exist. The Abstract Corpus Model (ACM), the basis for all implementations, supports these kinds of hierarchical structures. Additionally, ACM now supports constraints, partially aligned annotations and referential annotations. The XML-based EUDICO Annotation Format (EAF) was extended so that it now also supports these features.

For researchers who already have a considerable amount of annotations but prefer to do their time alignment later, a "bulldozer" import mode was created. It simplifies the input of such annotations, its association with tiers and its efficient time alignment. ELAN was further extended by an incremental save option and export of selected tiers and time intervals to a tablelike structure. The search facility was extended to allow multitier search, i.e., several patterns can now be associated with different tiers and be combined to create powerful search queries. Searching also supports dependency relations to prevent search queries that are not meaningful. Many other features such as inline editing and contextual menus were implemented as well.

Much time was spent identifying the reasons for the ongoing problems in achieving precise video presentation. It was established that the Java Media Framework, initially chosen for platform independence, does not play exactly the segments selected. Depending on the underlying operating system and software library version, JMF demonstrated various kinds of irregular behavior very problematic for certain types of study, such as gesture research. This research is dependent on exact frame location of the beginning and end of certain movements. Tests were conducted for switching to Quicktime and these turned out to be very positive. Starting 2003 all media presentation will be conducted using the Quicktime player. At this time ELAN will also go into use under Mac OSX.

In order to integrate old formats, work was done to create new converters and improve existing ones. A Word annotation converter allows the user to describe the structure of his Word file with the help of a small grammar. The Word file is parsed according to the user's specification and a proper annotation file in XML-EAF can be created. A newly developed converter allows the user to convert MediaTagger files (the old Mac-based annotation tool) to the EAF format without having to open MediaTagger. This allows researchers to efficiently convert their corpora to prepare them for ELAN. In addition, the frequently used ECONV converter was also improved.

A style of coding integrating various linguistic encodings into one compact tier was chosen by a large international project on gesture usage in conversation. What seems to be easily read by professional human interpreters proves very difficult for automatic procedures. A preliminary program was developed capable of translating gesture annotations using a Dutch-English dictionary, making these annotations available to larger groups of researchers. Another program was developed that allows the disentangling of the linguistic parts, finding patterns of interesting behavior and counting them so as to produce statistical results.

For the speech lab the TG produced an extension that allows for easy editing with PRAAT. This is currently being tested by the comprehension group.

Much time was spent simplifying access to our software tools via the Web Start mechanism. This allows even inexperienced users to download and launch programs easily. This mechanism operates both with and without an Internet connection.

13.5 Computer-based audio/video handling

Significant time and effort was again invested in dealing with video on computers for various purposes, such as running animations in experiments, archiving video in the MPEG2 encoding standard, and providing video fragments via streaming services on the web. It turned out that video handling is still an area where much inconsistency and incompatibility is common. The Institute's decision to change over to MPEG2 as its archiving format due to its improved resolution led to setting up a MPEG2 digitization station via a professional board. However, severe problems were encountered, such as crosstalk between audio channels

for two high-amplitude signals. Because of these problems the institute now uses a workflow in which DV streams are first transferred to a server after which a software-based transformation to MPEG2 is carried out. For this transformation it also had to be checked very carefully which software could be used, since some introduce delays between audio and video fragments that cannot be tolerated in such work as gesture or multimodality research. It turned out that this method allowed the TG to achieve the best possible audio quality, which is very important indeed for language research! Finally, it was found that the Tsunami MPEG Encoder software package performed best for Institute purposes and generated reliable media streams.

A similar problem occurred when video streaming was programmed for the Multimedia Indexing and Searching project (MUMIS). According to the documentation, the Darwin video streaming server should be able to transmit MPEG1 clips. However, it turned out that this was only true for films no longer than a few minutes. This meant that fragments at the end of a long video recording could not be addressed. Further tests must still be carried out in 2003. An alternative would be to use MPEG4, which is supported well by the Darwin streaming server.

13.6 Experimental facilities

Much work was conducted in experiment support, since a number of experimental facilities were set up, altered and the NESU software package further extended. Several NESU setups were installed and extended at the F.C. Donders Center including a baby lab where EEG signals are also recorded, and other lab facilities were enhanced with video presentation or computer-based animation capabilities.

Among NESU2's new functions are the improved handling of tasks with multiple and moving pictures, the addition of a 48 bit I/O card to encode a larger number of events, added drag & drop features, in particular for eye-tracking experiments, and an extension to play video as stimuli. Further, NESU was tested under Win XP, since most notebooks are now delivered with this operating system. Some work had to be spent on checking Event-Action-Timing files (EAT) from researchers. Although it seems that the NESU user interface for defining the timing of new experiments is simple, it remains a serious problem for many to create efficient EATs without affecting the measured reaction times. From the TG's experience it

appears to be necessary to conduct training courses from time to time to exclude and correct certain user errors.

Special attention is required for video and audio processing, since also here NESU must guarantee timing accuracies. However, almost every new operating system version, version of the underlying media server software, or even media chip set creates differences in how media are processed. The fact that these differences are also dependent on the video encoding format (MPEG1/2/4, Sorensen) and even the media file format (AVI, QT,...) makes tightly controlled media presentation even more complex. All changes require many time-consuming tests, adaptations and new recommendations, and even every new notebook type used for experiments with media stimuli must be checked extensively to guarantee proper functioning.

NESU software is now available via the Web Start mechanism, which simplifies the downloading and launching of software.

By popular demand, a new NESU Box has been designed and the prototype extensively developed. This box has slightly less functionality compared to the "big" NESU Box offered by the company HASOMED, but the cost will be drastically lower. It is expected that the new box will be available for a price of under €500. This would make available a number of differently sized hardware boxes together with the NESU software – from very small boxes for one dual push-button box to the large NESU box for up to 6 dual push-button boxes, 2 voice keys, several pulse generators on variable frequencies, pulse read-in options and 8 input/output lines. This makes it possible for NESU to operate together with eye trackers, MRI scanners and many other types of experimental equipment.

13.7 Electronics and audio/video facilities

As every year many researchers had to be equipped for their field trips. Much time was spent in analyzing existing trends in everything from miniaturization to efficient power management in the field. Miniaturization is coupled with compression, therefore effort was made analyzing the effects of the ATRAC (Minidisc) and MP3 (MPEG) compression algorithms. Although the effects of these psychoacoustically based compression algorithms on normal speech in normal circumstances is small, there is a tendency to recommend audio recording equipment that does not have lossy compression. Especially when endangered languages

are recorded, the material has a cultural value beyond its immediate scientific usefulness. For archiving purposes one should record with the best possible quality.

Efficient power management is essential in many field situations. Therefore, tests were carried out with many types of equipment such as notebooks, cameras, recorders, solar panels and others to determine what their power consumption/generation characteristics were. The information was compiled and this document is available on the DOBES web site: www.mpi.nl/DOBES.

Further, new experimental setups were provided for the baby labs, the gesture lab and a lab for the COMIC project. These setups include some electronics for presentation purposes and video equipment for recording the subjects' activities. In addition, a number of animations were created and optimized for various fieldwork and laboratory situations.

13.8 Other Activities of the Technical Group

The head of the TG, Wittenburg, remained a member of the Central Computer Committee of the Max Planck Society. By fulfilling this function, support could be provided for several activities important to the society as a whole and advice given to a number of other institutes. In 2002 he was also appointed head of the section on metadata under the newly founded Technical Subcommittee (ISO TC37/SC4) dealing with Standards for Terminology and Management of Language Resources. Two senior developers, Broeder and Brugman, were appointed members of sections under the same ISO subcommittee.

14 OTHER ACTIVITIES

14.1 Honors/Awards

Abdel Rahman received the Heinz Heckhausen Junior Scientist Award from the German Psychological Society (DGPs).

Broeder, Brugman, and Dirksmeyer were honored with Heinz Billing Award 2002 for Scientific Computing.

Cutler was elected to the Koninklijke Hollandsche Maatschappij der Wetenschappen (Royal Holland Society of Sciences and Humanities) in Haarlem.

Schiller received the Vernieuwingsimpuls (VICI) from the Netherlands Organization for Scientific Research (NWO) to establish a research group at the University of Maastricht.

Weber received the Otto Hahn Medal for outstanding dissertations by young scientists in the Max-Planck-Gesellschaft (MPG).

14.2 Nijmegen Lectures

This year's Nijmegen Lectures were given by Michael Tomasello (MPI for Evolutionary Anthropology, Leipzig). The title of the series was "Evolutionary psychology and primate cognition". The series included three morning lectures: "Primate cognition", "The ontogeny of human social cognition" and "Language acquisition". The afternoon seminars were: "There's an outdoors as well – methodological issues" (with Richard Byrne, University of St. Andrews, as primary discussant), "The teleological stance?" (with George Gergely, Hungarian Academy of Sciences, as primary discussant), and "How far can a construction-based approach take

us?" (with Michael Thomas, Institute of Child Health, London, as primary discussant). Bowerman and Levinson (MPI Nijmegen) were also discussants in the afternoon sessions. The lectures were organized in collaboration with the Interfaculty Research Unit for Language and Speech (IWTS) of the U. Nijmegen. The series was organized by Baayen, P. Brown, Enfield, and Mauth.

14.3 The F.C. Donders Lectures on Cognitive Neuroscience

This lecture series was organized by Hagoort in collaboration with the Nijmegen Institute of Cognition and Information (NICI). Speakers in the 2002 series were: Birbaumer (U. Tübingen), Raichle (Washington U., St. Louis), Lopes da Silva (VU Amsterdam), and Miller (MIT, Boston). A special event in the 2002 series was the scientific meeting on "Cognitive Neuroscience beyond the Image" given on the occasion of the official opening of the F.C. Donders Centre for Cognitive Neuroimaging, Nijmegen.

14.4 Internal lectures

During 2002 eight speakers gave lectures in the Institute's Formal Colloquium series. The speakers were Muysken (U. Nijmegen), Himmelmann (Ruhr-Universität-Bochum), Nettle (Open U. London), Rayner (U. of Massachusetts, Amherst), Sebastián (U. de Barcelona), Slobin (U. of California, Berkeley/MPI Nijmegen), Friederici (MPI of Cognitive Neuroscience, Leipzig), and Striano (MPI for Evolutionary Anthropology, Leipzig). These lectures were organized by the Colloquium Committee (Enfield, Narasimhan, and Roelofs). Many informal lectures were also presented by long-term and occasional visitors to the Institute.

14.5 Teaching

Members of the Institute taught at the following institutions:

Bastiaansen (F.C. Donders Centre)

Bowerman (LOT Winter School, Leiden; VU Amsterdam;)

Cutler (Summer School Deutsche Gesellschaft für Sprachwissenschaft and Linguistic Society of America, U. Düsseldorf)

Dimroth (U. Köln; LOT Summer School)

Enfield (U. Köln; U. Nijmegen)

Ernestus (U. Nijmegen)

Faller (U. Nijmegen)

Gullberg (U. Nijmegen)

Hagoort (U. Amsterdam; U. Nijmegen; U. Rotterdam)

F. Hellwig (U. Amsterdam)

Indefrey (Summer School Deutsche Gesellschaft für Sprachwissenschaft and Linguistic Society of America, U. Düsseldorf; F.C. Donders Centre; U. Nijmegen)

G. Kempen (Leiden U.)

Matsuo (U. Ottawa)

Petersson (F.C. Donders Centre; Karolinska Institut, Stockholm)

Schiller (Maastricht U.; U. Nijmegen)

Senft (U. Köln; U. Nijmegen)

Vonk (U. Nijmegen)

14.6 Colloquia presented

The following members of the Institute presented colloquia at various institutions:

Abdel Rahman (Humboldt U.; U. Genève)

Ameika (La Trobe U.; U. Leuven)

Bastiaansen (U. Amsterdam; Maastricht U.)

Bohnemeyer, J. (U at Buffalo-SUNY)

Bowerman (Lehigh U.; VU Amsterdam)

P. Brown (U. Nijmegen)

Cutler (U. of Wales, Bangor; U. of Arizona; U. of Melbourne)

Dimroth (FU Berlin)

Eisenbeiß (U. Salzburg)

Enfield (U. Köln; U. Nijmegen; U. of Melbourne; MPI for Evolutionary Anthropology)

Faller (U. Nijmegen; U. Amsterdam; U. Düsseldorf)

Gullberg (Lund U.; U. Wageningen)

Hagoort (U. Utrecht; U. Genève)

Indefrey (U. Groningen; Maastricht U.; Forschungszentrum Jülich)

Jordens (U. Freiburg)

Kita (MPI for the History of Science)

Klein (U. Potsdam)

Levelt (National Chung Cheng U. Chiayi, Taiwan; National Science Council, Taipei, Taiwan)

Levinson (MPI für Wissenschaftsgeschichte, Berlin)

McQueen (U. de Provence; SISSA, International School of Advanced Studies, Trieste; U. of Kansas)

O'Connor (Leiden U.; U. Nijmegen; Rice U.; U. of New Mexico; U. of California at Santa Barbara)

Schiller (U. of Cambridge)

Schmiedtová (U. of Massachusetts, Amherst; MPI for Evolutionary Anthropology)

Senft (U. Bielefeld)

Seuren (U. Bonn; KNAW; U. Antwerpen; U. of Coimbra; U. of Athens; U. Potsdam)

Slobin (U. Hamburg; U. of Copenhagen)

Vonk (U. Osnabrück)

Wittenburg (Utrecht. U.; U of Lund; Deutsche Telekom Frankfurt)

14.7 Workshops organized:

Hoiting, Perniss, and Slobin established the Sign Language Research Group (SLRG), which held regular meetings throughout the year on issues of the structure, acquisition, and use of signed languages. Participants came from all over the Netherlands and Belgium for meetings that took place every two or three weeks, including a full-day workshop.

Senft and van Staden organized a workshop entitled "Serial Verb Constructions" at the 9th International Conference on Austronesian Linguistics in Canberra, January 7–11. Presentations were given by the following speakers: Van Staden and Reesink (MPI Nijmegen, Leiden U.), Bowden (RSPAS, Australian National U.), van Klinken (Australian National U.), Brill (CNRS Paris), Pawley (RSPAS, Australian National U.), Senft (MPI Nijmegen), Foley (U. of Sydney).

McQueen and Cutler, in collaboration with Content (Free U. Brussels), organized the workshop "Spoken Word Recognition" at the Joint Meeting of the British Experimental Psychology Society and the Belgian

Content (Free U. Brussels), Mattys (U. Bristol), and Norris (MRC-CBU Cambridge).

Wittenburg, in collaboration with Austin (U. Melbourne) and Dry (East Michigan U.) organized a workshop entitled "International Workshop on Tools and Resources in Field Linguistics" as a preconference workshop of the LREC 2002 Conference in Las Palmas, May 26–27. Presentations were given by a large number of internationally recognized specialists and researchers (www.mpi.nl/lrec).

Brugman, Skiba and Wittenburg organized the DOBES Training Workshop in Nijmegen (6–10 May). Presentations were given by members of the Technical Group of the MPI and external experts such as U. Mosel (U. Kiel), J. Gippert (U. Frankfurt), A. Dwyer (U. of Kansas), and B. Hellwig (MPI Nijmegen).

Levinson organised a preliminary workshop for future members of the Island Melanesia Project (2–3 May). Participants were Levinson (MPI Nijmegen), Dunn (ANU), Terrill (AIATSIS), Lindström (U. Stockholm), Foley, Lahr, (both Cambridge), Reesink (U. Leiden).

Özyürek (Koç U.), Allen (Boston U.), and Kita organized a symposium entitled "The function of gestures in language development" at 9th Congress for International Association for the Study of Child Language (IASCL). Madison, Wisconsin, July. Papers were given by Goldin-Meadow (U. of Chicago), Mayberry (McGill U.), McNeill (U. of Chicago), Nicoladis (U. of Alberta), Senghas (Barnard College), and the organizers. Bowerman was the discussant for the symposium.

Terrill and Dunn organised the first full workshop for the Island Melanesia Project (4–5 July 2002). Participating from MPI Nijmegen were Levinson, Reesink, Terrill, van Staden and Dunn. The participants from Cambridge were Foley, Lahr and Migliano. Other participants were Lindström (U. Stockholm), Kayser (MPI Evolutionary Anthropology, Leipzig) and Gosden (Oxford).

Petersson organized a research seminar series in cognitive science "Cognitive Models and the Nature of Psychological Explanation" in July, October, and December at the Cognitive Neurophysiology Research Group, Department of Clinical Neuroscience, Karolinska Institute, Stockholm.

On behalf of the Dynamics of Learner Varieties Project, Habertzettl, Wegener (both U. Potsdam) and Dimroth organized the fourth of a series of international conferences under the aegis of the European Science Foundation and the High-Level Scientific Conferences program of the European Commission. The conference was held in Kolymbari (Greece), 12–17 October, and was entitled "The End State of Language Acquisition". The conference heard 24 plenary addresses, half presented by members of the project, half presented by outside scientists, and there was a poster session. Plenary speakers from the Institute were: Dimroth, Schmiedtová, Gretsche, Gullberg, Kirsch.

Broeder and Wittenburg organized the IMDI Metadata workshop in Nijmegen, November 14–15. Presentations were given by a number of recognized European specialists and researchers (www.mpi.nl/ISLE).

Bastiaansen, in collaboration with Hagoort, Fries and Jensen (F.C. Donders Centre, Nijmegen), organized a workshop entitled "Oscillatory Brain Dynamics in Human Cognition" at the F.C. Donders Centre on November 26–27. Presentations were given by Makeig (U. California at San Diego), Bertrand (U. Lyon), Lachaux (U. Paris), Lutzenberger (U. Tübingen), Engel (U. Hamburg) Lopes da Silva (U. Amsterdam), Fries (F.C. Donders Centre), Jensen (F.C. Donders Centre), and Bastiaansen (MPI).

Dimroth organized the workshop "Der Altersfaktor im Spracherwerb" together with von Stutterheim (U. Heidelberg) at the 24th Annual Meeting of the German Linguistics Society (DGfS) in Mannheim. Presentations were given by the following speakers: Bast (U. Köln), Birdsong (U. Texas), Bongaerts (U. Nijmegen), van Boxtel (U. Nijmegen), Carroll (U. Heidelberg), Dietrich (HU Berlin) and Weissenborn (U. Potsdam), Gretsche (MPI Nijmegen) Tracy (U. Mannheim), Habertzettl (U. Potsdam) Naumann (FU Berlin), Möhring and Meisel (U. Hamburg), Schulz (U. Konstanz), Singleton (Trinity College Dublin), and Watorek/Perdue/Benazzo (U. Paris VIII).

14.8 Presentations at conferences, congresses, and workshops:

Abdel Rahman, R., Turenout, M. van, & Levelt, W.J.M. "Organisation semantischer und phonologischer Verarbeitung bei Bildbenennung." 44.

Tagung experimentell arbeitender Psychologen (TeaP 2002). Universität Chemnitz, March.

Abdel Rahman, R., Turenout, M. van, & Levelt, W.J.M. "Semantic retrieval before phonological encoding in picture naming. How deep do we go?" 9th Annual Meeting of the Cognitive Neuroscience Society. San Francisco, CA. April.

Abdel Rahman, R., Turenout, M. van, & Levelt, W.J.M. "An electrophysiological examination of semantic and phonological encoding in picture naming". 8th Annual Conference on Architectures and Mechanisms for Language Processing. Tenerife (Spain), September.

Abdel Rahman, R. "Elektrophysiologische Untersuchung semantischer und phonologischer Verarbeitung bei Bildbenennung." 43. Kongress der Deutschen Gesellschaft für Psychologie. Berlin, September.

Aboh, E. O., Ameka F.K., & Essegbey, J. "Moving from verbs to prepositions in Gbe (West Africa)." International Conference on Adpositions of Movement. U. Leuven, January.

Alibali, M. & Kita, S. "Function of gesture in speaking." Gesture: The living medium. 1st Congress of the International Society for Gesture Studies. U. of Texas at Austin, June.

Alibali, M. & Kita, S. "Function of gesture in speaking." Symposium on Research in Child Language Disorders. 9th Congress for International Association for the Study of Child Language (IASCL). Madison, Wisconsin, July.

Allen, S., Özyürek, A., Kita, S., Brown, A., & Turanli, R. "Development of iconic gestures in typologically different language" 9th Congress for International Association for the Study of Child Language (IASCL). Madison, Wisconsin. July.

Allen, S., Özyürek, A., Kita, S., Brown, A., Turanli, R., & Ishizuka, T. "Early speech about manner and path in Turkish and English: Universal or language-specific?" 27th Annual Boston University Conference on Language Development. Boston, MA, November.

Alphen, P.M. van "An acoustical study of the voicing distinction in Dutch plosives". 143rd Meeting of the Acoustical Society of America. Pittsburgh, PA, June.

Ameka, F.K. "Two adposition classes in Likpe: A case of metatypy?" *Pearls at Peril: Linguistic Lectures on Endangered Languages*. Leiden U., February.

Ameka, F.K. "Deprived languages, dying languages and endangered languages" [invited talk]. UNESCO-Nederland Experts Meeting on Intangible Cultural Heritage. Den Haag, February.

Ameka, F.K. "Three argument verbs in West African serialising languages." *Dative Days*. Institut für Afrikanistik, Köln, June.

Ameka, F.K. "Prepositions and postpositions in Likpe: An areal adaptation?" *Linguistics Department Seminar*. La Trobe U., Melbourne, August.

Ameka, F.K. "The adjective class in Ewe." *International Workshop on Adjective Classes*. Research Centre for Linguistic Typology. La Trobe U., Melbourne, August.

Ameka, F.K. "Today is far away: Situational anaphors in multiverb constructions in Ewe." *Annual Colloquium of the Legon-Trondheim Linguistics Project*. U. of Ghana, Legon, Accra, December.

Bastiaansen, M., Linden, M. van der, Keurs, M. ter, Dijkstra, T., & Hagoort, P. "Open-class words produce a larger theta power increase than closed-class words." *9th Annual Meeting of the Cognitive Neuroscience Society*. San Francisco, CA, April.

Bastiaansen, M. "EEG theta power is sensitive to different aspects of language processing." *6th Annual Dutch Endo-Neurometing*. Doorwerth (Netherlands), June.

Bohnemeyer, J. "Activity nouns, unaccusativity, and argument marking in Yukatekan". *Annual Meeting of the Society for the Study of the Indigenous Languages of the Americas*. San Francisco, CA, January.

Borgwaldt, S., Hellwig, F., Jakab, E., & De Groot, A.M.B. "Nucleus entropy: An investigation into Hungarian vowel harmony." *6th International Conference on the Structure of Hungarian*. Düsseldorf, September.

Borgwaldt, S., Hellwig, F., & De Groot, A.M.B. "Entropy in language(s)-comparing alphabetic orthographies." *3rd International Conference on the Mental Lexicon*. Banff, Alberta (Canada), October.

Borgwaldt, S., Hellwig, F., & De Groot, A.M.B. "Entropy in language(s)-comparing alphabetic orthographies." 43rd Annual Meeting of the Psychonomic Society. Kansas City, MO, November.

Boves, L. & Os, E., den "Multimodal and multilingual services for small mobile terminals". EURESCOM Summit 2002. Heidelberg, October.

Bowerman, M. "Containment, support, and beyond: Constructing language-specific topological categories in first language acquisition" [Invited talk]. Conference on Categorization of Spatial Entities in Language and Cognition. Institut de Recherche en Informatique de Toulouse, January.

Bowerman, M. "Space under construction: A crosslinguistic perspective on the acquisition of spatial semantic categories" [Keynote address]. 7th International Columbia School Conference on the Interaction of Linguistic Form and Meaning with Human Behavior. Columbia U., New York, February.

Bowerman, M., Brown, P., Eisenbeiß, S., Narasimhan, B., & Slobin, D.I. "Putting things in places: Developmental consequences of linguistic typology" [Keynote panel]. 31st Stanford Child Language Research Forum. Stanford, CA, April.

Bowerman, M., Discussion "Symposium on Infant categorization of spatial relationships: Developmental changes and relation to language-specific cognitive categories". International Conference on Infant Studies. Toronto, April.

Bowerman, M. "Why can't you 'open' a nut or 'break' a noodle? Learning covert object categories inherent in action word meanings" [invited presentation]. 32nd Carnegie Symposium on Cognition: Building object categories in developmental time. Carnegie-Mellon U., Pittsburg, PA, June.

Bowerman, M. "Language-specific puzzles in first language acquisition" 9th Congress of the International Association for the Study of Child Language (IASCL). Madison, Wisconsin, July.

Brown, P. & Narasimhan, B. "Where are children going and where do they put things? Learning motion expressions in Tzeltal and Hindi." NET (NetwerkEersteTaalverwerving) Symposium. U. Nijmegen, March.

Brown P. & Narasimhan, B. "Getting the inside story: Motion verbs in Tzeltal and Hindi." Talk presented at Festive Symposium in Honor of Melissa Bowerman on the Occasion of her 60th Birthday". MPI Nijmegen, April.

Brown, P., León, L. de, Pfeiler, B., & Pye, C. "The acquisition of agreement in Maya." 9th Congress of the International Association for the Study of Child Language (IASCL). Madison, Wisconsin, July.

Brown, P. "Culture-specific influences on semantic development: Acquiring the Tzeltal 'benefactive' construction." 9th Congress of the International Association for the Study of Child Language (IASCL). Madison, Wisconsin, July.

Broeder, D. & Hellwig, B. "Metadata principles and tools." DOBES Training Workshop. Nijmegen, April.

Broeder, D. "Praat introduction." DOBES Training Workshop. Nijmegen, April.

Broeder, D. "De COREX exploratie software voor het Corpus Gesproken Nederlands." Fries Filologen Congres. Leeuwarden (Netherlands), December.

Brugman, H. & Hellwig, B. "Introduction to speech and video analysis with ELAN." DOBES Training Workshop. Nijmegen, April.

Brugman, H. "Tool distribution policy". DOBES Training Workshop. Nijmegen, April.

Carlsson, K., Petrovic, P., Andersson, J., Fransson, P., Petersson, K.M., Öhman, A., & Ingvar, M. "Manipulation of temporal predictability in repeated somatosensory stimuli." 8th International Conference on Functional Mapping of the Human Brain. Sendai (Japan), June.

Cho, T. "Manifestation of prosodic structure in articulation: Evidence from lip movement kinematics in English." 8th Conference on Laboratory Phonology (LabPhon8). New Haven, CT, June.

Cholin, J., Schiller, N.O., & Levelt, W.J.M. "Die Rolle der Silbe an der Schnittstelle zwischen phonologischer und phonetischer Enkodierung im Sprachproduktionsprozess" 44. Tagung experimentell arbeitender Psychologen (TeaP 2002). Chemnitz, March.

Cholin, J., Schiller, N.O., & Levelt, W.J.M. "The preparation of syllables in speech production". 8th Conference on Laboratory Phonology (LabPhon8). New Haven, CT, June.

Cholin, J. & Levelt, W.J.M. "The mental syllabary". Tutorials in Brain Sciences (TuBBs) Summerschool. Kochel am See (Germany), July.

Cutler, A. "Universal processes and language-conditioned processes in the recognition of continuous speech." ESF Exploratory Workshop on the Neurobiology of Communication: Comparative and Evolutionary Perspectives on Receptive Language. Cambridge, September.

Dahan, D. & Tanenhaus, M.K. "Continuous integration of phonetic and semantic constraints on spoken-word recognition: Evidence from eye movements." 8th Annual Conference on Architectures and Mechanisms for Language Processing. Tenerife (Spain), September.

Dahan, D. & Tanenhaus, M.K. "Activation of conceptual representations during spoken-word recognition." 43rd Annual Meeting of the Psychonomic Society. Kansas City, MO, November.

Dietrich, C. & Swingle, D. "Infants' processing of language-specific vowel information in linguistic context". 27th Annual Boston University Conference on Language Development. Boston, MA, November.

Dimroth, C. & Haberzettl, S. "The older the better. Untutored L2 acquisition in children." ESF EURESCO Conference on the Structure of Learner Language "The End State of Acquisition." Kolymbari (Greece), October.

Dirksmeyer, R. & Wittenburg, P. "Future Fieldwork scenarios." DOBES Training Workshop. Nijmegen, April.

Dittmar, N., Kirsch, K., & Schmidt, K. "Learning a second language at the 'third age.' The acquisition of discourse markers, modal particles and subordination strategies." ESF EURESCO Conference on the Structure of Learner Language "The End State of Acquisition." Kolymbari (Greece), October.

Dunn, M., Reesink, G., & Terrill, A. "The East Papuan languages: A preliminary typological appraisal". 5th International Conference on Oceanic Linguistics. Canberra, January.

Enfield, N.J. "Bi-clausal expression of 'cause' in mainland Southeast Asia." Annual Meeting of the Berkeley Linguistics Society, Berkeley CA, February.

Enfield, N.J. "Micro- and Macro-dimensions in linguistic systems." Conference on Reviewing Linguistic Thought: Perspectives into the 21st Century. Athens, May.

Enfield, N.J. "Editing gesture diagrams: Manipulating the cohesion of virtual diagrams in gesture space." 1st Congress of the International Society for Gesture Studies. U. of Texas at Austin, June.

Enfield, N.J. & Kita, S. "Deictic gesture: different forms for different communicative functions." 1st Congress of the International Society for Gesture Studies. U. of Texas at Austin, June.

Enfield, N.J. "Adjectives in Lao – a sub-type of verbs." International Workshop on Adjective Classes. Research Center for Linguistic Typology, La Trobe U. Melbourne, August.

Enfield, N.J. "Language areas and typological poise." Workshop on Areal Linguistics, LTRC Annual Meeting. Utrecht, September.

Enfield, N.J. "Representing kinship relations using cospeech gesture: How Lao speakers use space in spontaneously structuring a non-spatial domain." Workshop on Space and Cognition. MPI for the History of Science, Berlin, November.

Ernestus, M. & Mak, P. "Analogie-effecten bij het lezen van fout gespelde werkwoordsvormen." Minisymposion Lezen. MPI Nijmegen, May.

Ernestus, M. & Baayen, R.H. "The functionality of incomplete neutralization in Dutch: The case of past-tense formation." 8th Conference on Laboratory Phonology (LabPhon8). New Haven, CT, June.

Ernestus, M. & Mak, P. "The reading of Dutch misspelled verb forms." 3rd International Workshop on Writing Systems. U. Köln, September.

Federmeier, K. D., Coulson, S., Korvorst, E., Meeuwissen, M., & Kutas, M. "Hemispheric asymmetries for lexical and sentential context: ERP evidence." 9th Annual Meeting of the Cognitive Neuroscience Society. San Francisco, CA, April.

Frank, S.L., Koppen, M., Noordman, L.G.M., & Vonk, W. "A computational model for inferencing during story comprehension". 1st Annual Summer Interdisciplinary Conference. Squamish (Canada), August.

Forkstam, C., Ingvar, M., & Petersson, K.M. "Event-related functional MR of grammaticality judgments in an artificial grammar." 8th International Conference on Functional Mapping of the Human Brain. Sendai (Japan), June.

Gisselgård, J., Petersson, K.M., Baddeley, A., & Ingvar, M. "Neural correlates of the irrelevant speech effect." 8th International Conference on Functional Mapping of the Human Brain. Sendai (Japan), June.

Goudbeek, M., Smits, R., & Swingley, D. "Unsupervised learning of unidimensional and multidimensional auditory categories". 43rd Annual Meeting of the Psychonomic Society. Kansas City, MO, November.

Gullberg, M. "Anaphoric linkage in gesture and speech in learner varieties." 1st Congress of the International Society for Gesture Studies. U. of Texas at Austin, June.

Gullberg, M. & Kita, S. "Addressees' attention to gestures: Information uptake and visual fixations." 1st Congress of the International Society for Gesture Studies. U. of Texas at Austin, June.

Gullberg, M. "Anaphoric linkage in early L2 speech and gesture. For you or me?" European Second Language Association (EUROSLA 12). Basel, September.

Gullberg, M. "I see what you mean: What gestures can reveal about language-specific processing in advanced learners" [invited talk]. ESF EURESCO Conference on the Structure of Learner Language "The End State of Acquisition." Kolybari (Greece), October.

Gulrajani, G. "Web lexicon tool introduction." DOBES Training Workshop. Nijmegen, April.

Hagoort, P. "De boezem in eigen hand steken." Bessensap: Wetenschap ontmoet pers. Floriade, Amsterdam, April.

Hagoort, P. "Perspectives on semantic integration and Mike's reincarnation." Information Processing and Error Analysis. A meeting to honor Professor Michael Coles' contribution to Psychology and Neuroscience. Urbana-Champaign, IL, April.

Hagoort, P., Hald, L., Petersson, K.M. & Indefrey, P. "Semantic versus world knowledge integration during sentence comprehension." 9th Annual Meeting of the Cognitive Neuroscience Society. San Francisco, CA, April.

Hagoort, P. "De periscoop van het taalbewustzijn in de duikboot van ons brein." Conference of the Association Néerlandaise de Linguistique Appliquée. Utrecht, May.

Hagoort, P. "How the brain solves the binding problem for language." 6th Annual Dutch Endo-Neuromeeting. Doorwerth (Netherlands), June.

Hagoort, P., Hald, L., Petersson, K.M., & Indefrey P. "Semantics vs. general knowledge processing." 8th International Conference on Functional Mapping of the Human Brain. Sendai (Japan), June.

Hagoort, P. "The neural dynamics of semantic interpretation." International Symposium on Assessing the Dynamics of Human Brain Functions. Marburg, August.

Hagoort, P. "When speech hits the ear: From sound to meaning." Meeting of the Collegium Otorhinolaryngologicum. Noordwijk (Netherlands), August.

Hagoort, P. "Cognitive Neuroscience beyond Paul Valéry. Cognitive Neuroscience beyond the image given". Scientific Meeting on the Occasion of the Official Opening of the F.C. Donders Centre for Cognitive Neuroimaging. Nijmegen, September.

Hagoort, P. "Is the speaking brain a conscious brain?" Conference on the Transparent Brain: Neuroimaging – the Key to Human Consciousness. Düsseldorf, December.

Hagoort, P. "How the brain solves the binding problem for language". Neuronord. Bremen, December.

Hagoort, P. "Herman, brein en bewustzijn". Symposium on Stem- Spraaken Taalstoornissen: Onderzoek in Ontwikkeling. Nijmegen, December.

Hald, L. & Hagoort, P. "The integration of semantic versus world-knowledge information during on-line sentence processing." 6th Annual Dutch Endo-Neuromeeting. Doorwerth (Netherlands), June.

Heinzel, S., Plesser, T., & Wittenburg, P. "Archivierung elektronischer Dokumente in der MPG - Zukünftige Anforderungen." 15. IT-Treffen der MPG Göttingen, November.

Hellwig, B. "Shoebox introduction". DOBES Training Workshop. Nijmegen, April.

Hiss, R. & Wittenburg, P. "Legal & ethical aspects within the DOBES program." DOBES Training Workshop. Nijmegen, April.

Hoop, H. de & Narasimhan, B., "Optimization of case in Hindi." Taalbulletin Dag Workshop. U. Groningen, June.

Hoop, H. de & Narasimhan, B. "Optimization of case in Hindi" [invited talk]. Amsterdam Center for Language and Communication Seminar. Amsterdam, September.

Hoop, H. de & Narasimhan, B., "Optimizing case in Hindi." 6th Workshop on Optimality Theory Syntax. U. Potsdam, October.

Indefrey, P. "The functional anatomy of syntactic processing." Utrecht Institute of Linguistics Workshop on Neurocognitie & Taaltheorie. Utrecht, June.

Indefrey, P. "Anatomy of speech production and word finding: Meta-analysis of imaging data." Euresco Conference on The Science of Aphasia. Acquafredda di Maratea (Italy), June.

Indefrey, P., Hellwig, F., Herzog, H., Seitz, R.J., & Hagoort, P. "A PET study on the production and comprehension of identical sentences." 8th International Conference on Functional Mapping of the Human Brain. Sendai (Japan), June.

Indefrey, P. & Levelt, W.J.M. "The spatial and temporal signatures of word production components." 8th International Conference on Functional Mapping of the Human Brain. Sendai (Japan), June.

Indefrey, P. "A PET experiment on the influence of input-modality and task on the neural correlates of word semantics." Institute for Cognitive Neuroscience Workshop on Concepts and Languages. London, September.

Indefrey, P. & Hellwig, F. "A PET study on the production and comprehension of identical sentences" [invited talk]. Workshop on Language and Motor Integration: Neuroimaging and Computational Modeling. Edinburgh, September.

Ischebeck, A., Indefrey, P., Taira, M., & Usui, N. "In search of the visual input lexicon: The role of visual familiarity." 9th Annual Meeting of the Cognitive Neuroscience Society. San Francisco, CA, April.

Ischebeck, A., Indefrey, P., Usui, N., & Taira, M. "Identifying neural correlates of phonological encoding and lexical processes: The role of visual familiarity." 8th International Conference on Functional Mapping of the Human Brain. Sendai (Japan), June.

Janßen, U., Eisenbeiß, S., & Penke, M. "Psycholinguistic evidence for the underspecification of morpho-syntactic features: A sentence-matching study on German noun-phrase internal agreement." 3rd International Conference on the Mental Lexicon. Banff, Alberta (Canada), October.

Jordens, P. "Learner varieties and the study of attrition." [keynote address]. International Conference on first Language Attrition: Interdisciplinary Perspectives on Methodological Issues. VU Amsterdam, August.

Jordens, P. "Why children won't fossilize." European Second Language Association (EUROSLA 12). Basel, September.

Jordens, P. "The acquisition of finiteness and verb-second in L1 and L2 Dutch." ESF EURESCO Conference on the Structure of Learner Language "The End State of Acquisition." Kolymbari (Greece), October.

Kempen, G. "Terug naar Wundt: Pleidooi voor integraal onderzoek van taal, taalkennis en taalgedrag." Discussiedag van de Koninklijke Akademie van Wetenschappen over Verkenning Taal- en Letterkunde. Amsterdam, March.

Kempen, G. & Harbusch, K. "Rethinking the architecture of human syntactic processing: The relationship between grammatical encoding and decoding." 35th Meeting of the Societas Linguistica Europaea (SLE). Potsdam, July.

Kempen, G. & van Breugel, C. "A workbench for visual-interactive grammar instruction at the secondary education level." 10th International Conference on Computer-Assisted Language Learning (CALL-2002). Antwerpen, August.

Kempen, G. "Syntactic priming as preformatted grammatical encoding." Annual Meeting of the DFG-Schwerpunkt Sprachproduktion. Frankfurt, September.

Kho, K.H., Rutten, G.J.M., Hagoort, P., Indefrey, P., Rijen, P.C., Veelen, C.W.M. van, & Ramsey, N.F. "Language related fMRI activation in the temporal pole of epilepsy patients who were candidates for anterior temporal lobectomy; what does it represent?" Euresco Conference on The Science of Aphasia. Acquafredda di Maratea (Italy), June.

Kirsch, K. "How do Russian immigrants subordinate in German?" Workshop on the Dynamics of Learner Varieties. Paris, April.

Kita, S., Özyürek, A., Allen, S., & Brown, A. "Crosslinguistic variation of iconic gesture" 76th Annual Meeting of the Linguistic Society of America, San Fransisco, CA, January.

Kita, S. "What spontaneous speech-accompanying gestures reveal about linguistic shaping of concepts". Workshop on Concepts and Languages. London, September.

Kita, S. "We think, therefore we gesture: Speaker-internal function of spontaneous gestures". Daiikkai ninchi to kooi ni tsuite no kenkyuukai [1st colloquium on cognition and action]: Imishori ni okeru jyouhoo toogoo katei no kaimei [Information integration processes in the semantic processing]. Nagoya (Japan), September.

Klein, W. "On times and Arguments." VII Jahrestagung der Gesellschaft für Semantik on Sinn und Bedeutung. Konstanz, Oktober.

Klein, W. "Argumentation and Argument." Symposium der Arbeitsgruppe Sprache des Rechts. Berlin, November.

Klein, W. & Dimroth, C. "Der ungesteuerte Zweitspracherwerb Erwachsener: Ein Überblick über den Forschungsstand". Workshop on Qualitätsanforderungen für die Sprachförderung im Rahmen der Integration von Zuwanderern. Osnabrück, November.

Kramer, M. & Brom, N. "Tool Installation via the web and CDROMs." DOBES Training Workshop. Nijmegen, April.

Kramer, M. "UNICODE Issues." DOBES Training Workshop. Nijmegen, April.

Lausberg, H. & Kita, S. "Neglect of the left space in communicative gestures by the right hand in split-brain patients". 20th European Workshop on Cognitive Neuropsychology. Bressanone (Italy), January.

Levelt, W.J.M. "Multiple lexical acces in speech production" 9th Australian International Conference on Speech Science and Technology (SST-2002). Melbourne, December.

Levinson, S.C. & Meira, S. "Patterns of semantic discrimination in spatial adpositional systems." International Conference on Adpositions of Movement. U. Leuven, January.

Levinson, S.C. "Prospects for a new field: Semantic typology." International Linguistics Conference. Athens, May.

Lüpke, F. "The Jalonke and its speakers – at the margins of Mande." 5th International Conference on Mande Studies. Leiden U., November.

Lüpke, F. "The dative in Jalonke". Workshop on the Dative and its Counterparts in African Languages. U. Köln, June.

Lundström, B.N., Johansson, M., Petersson, K.M., Fransson, P., Andersson, J. & Ingvar, M. "An fMRI study of remembering perceived and imagined pictures." 8th International Conference on Functional Mapping of the Human Brain. Sendai (Japan), June.

Lundström, B.N., Johansson, M., Petersson, K.M., Fransson, P., Andersson, J. & Ingvar, M. "An fMRI study of remembering perceived and imagined pictures." 32nd Annual Meeting of the Society for Neuroscience. Orlando, FL, November.

Marklund, P., Nyberg, L., Cabeza, R., Forkstam, C., Petersson, K.M., & Ingvar, M. "Common frontal-lobe activations across multiple memory domains." 9th Annual Meeting of the Cognitive Neuroscience Society. San Francisco, CA, April.

McQueen, J.M., Spinelli, E., & Cutler, A. "Spoken word recognition in lexically ambiguous French utterances with liaison." 43rd Annual Meeting of the Psychonomic Society. Kansas City, MO, November.

McQueen, J.M., Smits, R., Cutler, A. & Warner, N. "The perception of gated Dutch diphones". 144th Meeting of the Acoustical Society of America. Cancun (Mexico), December.

Meeuwissen, M., Roelofs, A., & Levelt, W.J.M. "Planning levels in spoken numeral production". Tutorials in Brain Sciences (TuBBs) Summerschool. Kochel am See (Germany), July.

Meeuwissen, M., Roelofs, A., Levelt, W. J. M. "Seriality in naming and reading complex numerals: Eye-tracking evidence". 3rd International Conference on the Mental Lexicon. Banff, Alberta (Canada), October.

Melinger, A. & Dobel, C. "Lexically driven syntactic priming in sentence production". The 15th Annual CUNY Conference on Human Sentence Processing. New York, March.

Melinger, A. "Morphological structure in the lexical representations of prefixed words: Evidence from Speech Errors". 10th International Morphology Meeting. Budapest, May.

Melinger, A. "Evidence from the speaker for a communicative function of gesture". 1st Congress of the International Society for Gesture Studies. U. of Texas at Austin, June.

Melinger, A. & Abdel Rahman, R. "Exploring the interaction between phonological and semantic distractor effects on speech production". 8th Annual Conference on Architectures and Mechanisms for Language Processing. Tenerife (Spain), September.

Melinger, A. & Abdel Rahman, R. "Associative relations are semantic: Evidence from picture-word interference". 3rd International Conference on the Mental Lexicon. Banff, Alberta (Canada), October.

Mendonça, S., Faisca, L., Silva, C., Ingvar, M., Reis, A., & Petersson, K. M. "The role of literacy in the awareness of words as independent lexical units." 25th International Neuropsychological Society Meeting. Stockholm, July.

Mondini, M., Alphen, P.M. van, & Miller, J.L. "Native language influence on phonetic perception in Dutch-english bilinguals". 144th Meeting of the Acoustical Society of America. Cancun (Mexico), December.

Narasimhan, B. & Cablitz, G. "Granularity in the crosslinguistic encoding of motion and location." 3rd Annual Workshop on Language and Space. U. Bielefeld, July.

Narasimhan, B. & Budwig, N. "Argument realization in early child Hindi." Workshop on Variation in Form versus Variation in Meaning. U. Nijmegen, July.

Noordman, L.G.M. & Vonk, W. "Causal inferences". 44. Tagung experimentell arbeitender Psychologen (TeaP 2002). Chemnitz, March.

Norris, D., Cutler, A., & McQueen, J.M. "Lexical re-tuning of phonetic categories during speech perception." Joint Meeting of the Experimental Psychology Society and the Belgian Psychological Society. Leuven, April.

Petersson, K.M., Forkstam, C., & Ingvar, M. "Grammaticality judgments in the Reber grammar activates Broca's region." 8th International Conference on Functional Mapping of the Human Brain. Sendai (Japan), June.

Petersson, K.M., Reis, A., & Ingvar, M. "Cognitive processing in literate and illiterate subjects: Some recent behavioural and functional neuroimaging data." 25th International Neuropsychological Society Meeting. Stockholm, July.

Petersson, K.M. "Brain physiology." 4th Southern European School of the European Physical Society - Physics in Medicine. Faro, September.

Petrovic, P., Kalso, E., Petersson, K.M., & Ingvar, M. "Placebo and opioid analgesia – Imaging a shared neuronal network." 8th International Conference on Functional Mapping of the Human Brain. Sendai, (Japan), June.

Roelofs, A. "The relationship between speech production and speech perception" [keynote lecture]. Euresco Conference on the Science of Aphasia: Functional Neuroimaging Studies of Language and its Impairment. Acquafredda di Maratea (Italy), June.

De Ruiter, J.P.A., Vuurpijl, L., & Levelt, W.J.M. "SLOT: An experimental platform for studying multimodal communication." *Measuring Behavior*. Amsterdam, August.

Sandblom, J., Petersson, K.M., Elfgren, C., & Ingvar, M. "The visuo-spatial levels of processing effect: PET vs. fMRI." 8th International Conference on Functional Mapping of the Human Brain. Sendai (Japan), June.

Sandblom, J., Petersson, K.M., & Ingvar, M. "Meaningless search." 8th International Conference on Functional Mapping of the Human Brain. Sendai, (Japan), June.

Schiller, N. O., Schmitt, B. M., Peters, J., & Levelt, W. J. M. "'bANana' or 'baNAna'? Metrical encoding during speech production". 44. Tagung experimentell arbeitender Psychologen (TeaP 2002). Universität Chemnitz, March.

Schiller, N.O., Münte, T., Granzier, J., & Schmitt, B.M. "The influence of semantic and phonological factors on syntactic decisions". 9th Annual Meeting of the Cognitive Neuroscience Society. San Francisco, CA, April.

Schiller, N.O. "The time course of segmental and metrical encoding in speech production". 8th Conference on Laboratory Phonology (LabPhon8). New Haven, CT, June.

Schiller, N.O., Fikkert, P., & Levelt, C.C. "Metrical priming in speech production". 3rd International Conference on the Mental Lexicon. Banff, Alberta (Canada), October.

Schiller, N.O. "How do we know that tenor has stress on the first syllable whereas soprano has it on the second? Metrical stress in speech production". 3rd International Conference on the Mental Lexicon. Banff, Alberta (Canada), October.

Schiller, N.O. "The (limited) role of the onset in word and picture naming". 3rd International Conference on the Mental Lexicon. Banff, Alberta (Canada), October.

Schmiedtová, B. & Gretschek, P. "Young children's understanding of temporal expressions: Cognition before language". 32nd Annual Meeting of the Jean Piaget Society. Philadelphia, PA, June.

Schmiedtová, B., Gretschek, P. "Children's understanding of simultaneity and sequentiality." 9th Congress for International Association for the Study of Child Language (IASCL). Madison, Wisconsin. July.

Schmiedtová, B. & Gretschek, P. "The (unreliable) depiction of reality in linguistic data." ESF EURESCO Conference on the Structure of Learner Language "The End State of Acquisition." Kolybari (Greece), October.

Schmitt, B.M., Bles, M., Schiller, N.O., & Münte, T. "Overt naming in a picture-word interference task analyzed with event-related potentials". 9th Annual Meeting of the Cognitive Neuroscience Society. San Francisco, CA, April.

Schwichtenberg, B. & Schiller, N.O. "Semantic gender assignment regularities in German". 3rd International Conference on the Mental Lexicon. Banff, Alberta (Canada), October.

Seifart, F. "Nominal classification in Miraña, a Witotoan language of Colombia." *Pearls at Peril: Linguistic Lectures on Endangered Languages*. Leiden U., February.

Seifart, F. "Explaining apparently overly complicated systems of nominal classification as social badges." Annual Conference of the American Society for Geolinguistics, CUNY. New York, NY, October.

Senft, G. "Event conceptualization and event report in serial verb constructions in Kilivila – towards a new approach to research an old phenomenon". 9th International Conference on Austronesian Linguistics. Canberra, January.

Senft, G. "Serial verb constructions in Austronesian and Papuan languages: A sticky business". 5th International Conference on Oceanic Linguistics. Canberra, January.

Senft, G. "Frames of spatial reference in Kilivila" [invited talk]. Workshop on Feldforschung des SFB 282 on Theorie des Lexikons. Düsseldorf, February.

Shatzman, K.B. & Schiller, N.O. "The word frequency effect in picture naming: Contrasting two hypotheses using homophone pictures". 3rd International Conference on the Mental Lexicon. Banff, Alberta (Canada), October.

Silva, C., Fáisca, L., Mendonça, S., Ingvar, M., Petersson, K.M., & Reis, A. "Awareness of words as phonological entities in an illiterate population." 25th International Neuropsychological Society Meeting. Stockholm, July.

Skiba, R. & Guirardello, R. "The current DOBES Corpus – the Trumai Corpus as an example." DOBES Training Workshop. Nijmegen, April.

Skiba, R. & Wittenburg, P. "General workflow principles." DOBES Training Workshop. Nijmegen, April.

Skiba, R. "Transcriber introduction." DOBES Training Workshop. Nijmegen, April.

Skiba, R. & Brom, N. "Corpus integration." DOBES Training Workshop. Nijmegen, April.

Skiba, R., Brugman, H., Broeder, D., & Wittenburg P. "Corpus organization and access in field linguistics at the MPI". 3rd International Conference on Language Resources and Evaluation (LREC). Las Palmas (Spain), May.

Swingley, D. "The picture fixation method in infant speech comprehension research." 2nd McDonnell Foundation Workshop on Infant Cognition Methodologies. Venice. March.

Swingley, D. "The development of word recognition in infants and young children." Euresco conference on Brain Development and Cognition in Human Infants. Acquafredda di Maratea (Italy), June.

Swingley, D. "On the phonological encoding of novel words by one-year-olds". 27th Annual Boston University Conference on Language Development. Boston, MA, November.

Vonk, W., Schriefers, H., & Mak, W.M. "Animacy and topichood in sentence processing". 12th Annual Meeting of the Society for Text and Discourse. Chicago, IL, June.

Warner, N., Kim, J., Davis, C. & Cutler, A. "Phonological constraints and segmentation of spoken Korean." 8th Conference on Laboratory Phonology (LabPhon8). New Haven, CT, June.

Weber, A. & Cutler, A. "Phonetic discrimination and nonnative spoken-word recognition". 143rd Meeting of the Acoustical Society of America. Pittsburgh, PA, June.

Wittenburg, P. "Miscellaneous." Workshop on Linguistic Tools. Leiden, March.

Wittenburg, P. "Introduction to archiving in DOBES." DOBES Training Workshop. Nijmegen, April.

Wittenburg, P. & Viersen, R. van, "Power management in the field." DOBES Training Workshop. Nijmegen, April.

Wittenburg, P. "Metadata – future perspectives and ISO tasks." ISO TC37/SC4 Foundation Meeting. Las Palmas (Spain), May.

Wittenburg, P. "Methods for managing and accessing multimedia language resources." Workshop on Methods in Computational Linguistics. Leipzig, June.

Wittenburg, P. "Encoding and format standards for photos and video." Workshop on Processing of Photos for Scientific Purposes. Berlin, July.

Wittenburg, P. "Formats and tools for fieldwork." Workshop on Nilotic Languages. Leipzig, July.

Wittenburg, P. "Analysis of lexical structures from field linguistics and language engineering." 2nd International E-MELD Workshop. Ypsilanti, MI, August.

Wittenburg, P. & Brugman, H. "EUDICO: A tool set for annotating and exploiting multimedia signals." Measuring Behavior 2002. 4th International Conference on Methods and Techniques in Behavioral Research. Amsterdam, August.

Wittenburg, P. "Aspekte der Langzeit-Archivierung." BAR-Focus-Meeting. Tübingen, September.

Wittenburg, P. "IMDI metadata for lexica." IMDI Metadata Workshop. Nijmegen, November.

Wittenburg, P. "Situation der IT in der MPG aus Sicht des BAR." 15. IT-Treffen der MPG Göttingen, November.

Wittenburg, P. & Choukri, K. "Metadata perspectives and the INTERA & ECHO Projects." IMDI Metadata Workshop. Nijmegen, November.

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- Abdel Rahman, R., Sommer, W., & Schweinberger, S. R. (2002). Brain potential evidence for the time course of access to biographical facts and names of familiar persons. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 28, 366-373.
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- Ameka, F. K. (2002). Constituent order and grammatical relations in Ewe in typological perspective. In K. Davidse & B. Lamiroy (Eds.), *Nominative and Accusative and their counterparts. Case and grammatical relations across languages 4* (pp. 319-352). Amsterdam: John Benjamins.
- Ameka, F. K. (2002). Cultural scripting of body parts for emotions: On 'jealousy' and related emotions in Ewe. *Pragmatics and Cognition [special issue] 'The Body in Description of Emotion'*, 10, 25-53.
- Ameka, F. K. (2002). The progressive aspect in Likpe: Its implications for aspect and word order in Kwa. In F. K. Ameka & E. K. Osam (Eds.), *New Directions in Ghanaian Linguistics* (pp. 85-111). Accra: Black Mask.
- Ameka, F. K., & Osam, E. K. (Eds.). (2002). *New Directions in Ghanaian Linguistics*. Accra: Black Mask.

- Bastiaansen, M. C. M., Böcker, K. B. E., & Brunia, C. H. M. (2002). ERD as an index of anticipatory attention? Effects of stimulus degradation. *Psychophysiology*, 39, 16-28.
- Bastiaansen, M. C. M., Posthuma, D., Groot, P. F. C., & De Geus, E. J. C. (2002). Event-related theta responses in a visuo-spatial working memory task. *Clinical Neurophysiology*, 113, 1882-1893.
- Bastiaansen, M. C. M., van Berkum, J. J. A., & Hagoort, P. (2002). Event-related theta power increases in the human EEG during online sentence processing. *Neuroscience Letters*, 323, 13-16.
- Bastiaansen, M. C. M., van Berkum, J. J. A., & Hagoort, P. (2002). Event-related theta responses discriminate between number and gender agreement violations during online sentence processing. *NeuroImage*, 17, 1479-1492.
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- Bohnemeyer, J. (2002). *The grammar of time reference in Yukatek Maya*. Munich: LINCOM.
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- Bowerman, M. (2002). Taalverwerving, cognitie en cultuur. In T. Janssen (Ed.), *Taal in gebruik* (pp. 27-44). The Hague: Sdu.
- Bowerman, M., Brown, P., Eisenbeiß, S., Narasimhan, B., & Slobin, D. I. (2002). The crosslinguistic encoding of goal-directed motion in child-caregiver discourse. In E. V. Clark (Ed.), *Proceedings of the 31st Stanford Child Language Research Forum*. Stanford: Center for the Study of Language & Information. (Electronic proceedings: <http://cslipublications.stanford.edu/CLRF/2002/CLRF-2002-title.html>).
- Bowerman, M., Brown, P., Eisenbeiß, S., Narasimhan, B., & Slobin, D. I. (2002). Putting things in places: Developmental consequences of linguistic typology. In E. V. Clark (Ed.), *Proceedings for the 31st Stanford Child Language Research Forum*. Stanford: Center for the Study of Language & Information (Electronic proceedings:

<http://csli-publications.stanford.edu/hand/miscpubsonline.html>).

- Broeder, D., Offenga, F., & Willems, D. (2002). Metadata tools supporting controlled vocabulary services. In M. Rodríguez González & C. Paz Suárez Araujo (Eds.), *Proceedings of the 3rd International Conference on Language Resources and Evaluation (LREC 2002)* (pp. 1055-1059). Paris: European Language Resources Association.
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