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Preface

Bisogna cambiare tutto, perchè rimanga come prima.
G.T. di Lampedusa

In the life of an institute, there are times of rapid change and times of steady work. The year 2003 has not seen radical changes. After three most successful years as managing director, Anne Cutler has passed on this burden to me. This is one of those changes which are indispensable, if everything is to remain as before – and this means 'excellent', if we are to believe the comments from our Scientific Council that met in October for its biennial evaluation of the Institute.

Remaining as before does not mean standstill, it also involves new initiatives, most of which have already made their mark in the following research reports. One of these initiatives deserves particular mention: A workgroup under the direction of Ulrike Zeshan will study sign languages from a crosslinguistic point of view. Its aims are

- to pioneer the study of typological variation across a broad range of geographically and genetically unrelated sign languages
- to relate these findings to what we know about spoken languages (with implications for linguistic universals)
- to provide social, political and educational impulses for deaf communities, in particular in developing countries.

The project is funded by the Deutsche Forschungsgemeinschaft. One of its unique aspects is that it involves representatives of different sign languages as active researchers. Over the coming years we might well witness the naissance of a Nijmegen sign creole!

Wolfgang Klein

Nijmegen, March 2004

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1 PHONOLOGICAL LEARNING FOR SPEECH PERCEPTION

Introduction

- 1.1 Phonological learning in infancy
- 1.2 Learning of auditory categories in adulthood
- 1.3 Native phonology in adult listening

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Joint research with other projects:

Decoding Continuous Speech
The Dynamics of Multilingual Processing

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 funded by the NWO-supported Spinoza award to Cutler, in particular the research conducted in the two laboratories of the Baby Research Center: the behavioral laboratory located on the University of Nijmegen campus, and the laboratory for ERP research located in the F.C. Donders Centre for Cognitive Neuroimaging. Besides the experimental work with infants and young children conducted in these two labs (section 1.1), the project also includes studies of the computation and refinement 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 learning in infancy

Elizabeth Johnson joined the group in May of 2003. Under her guidance, the Baby Research Center's behavioral lab has been expanding to fill the extra space available at its new location on Montessorilaan. Most notably, a new Headturn Booth has been added, specifically designed to test infants as young as 4.5 months. This expansion has not only allowed the lab to increase the size of its subject pool, but has also increased the breadth of research topics studied in the lab. Understanding how older infants and toddlers represent words is still a major theme, but new work also addresses how and when very young infants acquire the basic speech processing abilities underlying subsequent word segmentation and recognition skills. Crosslinguistic studies comparing the phonological development of Dutch- versus English-learning infants are also made possible by the existence of a replica of the lab's new booth at Purdue U.

1.1.1 Word structure and word perceptibility for infants

In collaboration with Seidl (Purdue U.), Johnson has conducted a series of experiments designed to explore infants' perception of onsetless words. Their past research has shown that English-learning infants can segment consonant-initial words from a stream of speech much earlier than they can segment vowel-initial (onsetless) words. Their new studies compared perceptual versus phonological explanations for infants' difficulties with onsetless words. If young infants' inability to extract onsetless words from fluent speech were driven by a phonological constraint against onsetless words, then infants should display a general listening preference for words with onsets over words without onsets. However, when English-learning 11-month-olds were presented with lists of vowel-initial versus consonant-initial words in isolation, they demonstrated no

listening preference for consonant-initial words. In addition, if infants had a phonological constraint against accepting onsetless words as viable word candidates, this should affect words in any position in a sentence. Headturning studies, however, showed that English-learning 11-month-olds can extract and subsequently recognize vowel-initial words if they are always located in sentence-initial position, but these same infants demonstrated no subsequent recognition of onsetless words that had been presented in sentence-medial position. The evidence thus far therefore supports a perceptual rather than a phonological account.

1.1.2 Infant segmentation of words from continuous speech: ERP evidence

Kooijman, Hagoort and Cutler conducted an ERP study on word segmentation from continuous speech in 10-month-old infants. Behavioral studies have shown that infants begin to recognize words in continuous speech by 7.5 to 9 months of age. To study this step in language development in more detail, a new ERP paradigm was designed, consisting of an initial familiarization phase followed by a test phase. In the familiarization phase, 10-month-old Dutch participants were presented with blocks of ten tokens of the same isolated bisyllabic word with stress on the first syllable (e.g., *hofnar* 'court jester'); then in the following test phase they heard eight sentences, half of which contained the familiarized word. The other sentences also contained a bisyllabic word with stress on the first syllable, but one with which the infant subject had not been familiarized in the first phase (e.g., *python* 'python'). The mean length of the isolated words was 710 ms; the mean length of the critical words in the sentences was 721 ms. During presentation of the words and sentences EEG was measured. The results show a clear ERP effect, in the form of a negativity with an onset of 340 ms, on the familiarized words in the sentences as compared to the unfamiliar words. The effect is mostly present on the electrodes over the left hemisphere and midline. These results show that 10-month-old infants can indeed segment words from continuous speech. Moreover, even when the words occur in a continuous speech context, the infants only need the first part of the word to initiate their recognition response.

1.1.3 Crosslinguistic differences in infants' use of phonetic information in word learning

In speech perception some acoustic variation is relevant to the phonology of the language and some is not. For instance, some languages (e.g., Dutch) distinguish vowels by length, others (e.g., English) do not. However, Dietrich's thesis research, using the conditioned headturn paradigm, had shown (see Annual Report 2002) that both Dutch and Canadian infants use vowel length in a word similarity judgment task. One possible explanation was that vowel length

may have been processed at a more abstract level of generalization in this task, and hence infants may not have used their phonological knowledge.

To ascertain to what extent infants' knowledge is used in a more referential task, Dietrich thus conducted a further series of studies exploring Dutch and Canadian infants' learning of novel word-forms that differed either in vowel length or in vowel quality. (The latter comparison served as a control to ensure that the task was working.) The studies in Canada were conducted in collaboration with Werker (U. British Columbia). Instead of conditioned headturn, the new studies used the switch paradigm. 17-19 month-old infants were habituated to a visual display of two novel objects (i.e., two animated pictures), one paired with word A and one paired with word B. The word-forms used were *tam* and *taam* for the vowel length study and *tam* and *tem* for the vowel quality study. The two word-object combination trials alternated until infants habituated to the pairings. Habituation was defined as a decrease in looking time at the display to a prespecified criterion level (here: 50%). Looking time was coded online and the test phase of the study began once the habituation criterion had been met. During testing, infants were presented with four critical word-picture pairings during which the familiar associative link was either maintained ('same') or violated ('switch'). Dutch infants' looking time increased significantly to the violation of the novel word-object pairing when the word-forms differed either in vowel length or in vowel quality. Canadian infants dishabituated to the violation of the word-picture pairing only when the critical word-forms differed in vowel quality, but not when they differed in vowel length. It appears, therefore, that Canadian infants did not employ vowel length as a cue to word-learning. This difference between the two populations was in line with the predictions from the phonology: vowel quality is phonemic - and should therefore qualify as a meaningful cue during word-learning - in both languages, but vowel length is phonemic only in Dutch, not in Canadian English. Thus although in the first year of life both Canadian and Dutch infants used vowel duration in a word-categorization task, only Dutch one-year-olds could learn novel word-forms that differed in vowel duration in a specific word-learning task. In the latter situation, infants seemed to draw upon their knowledge of their native sound system. As linguistic experience increases, infants' perceptual sensitivities develop into language-specific phonological knowledge.

1.1.4 Word class and its role in infants' word learning

Together with Shi (U. Montreal) and Werker (U. British Columbia), Cutler further examined the role of function words in initial recognition of content words. Their earlier work (Annual Report 2002) had shown that 13-, but not 8-month-old English-learning infants recognise function words (both frequent and infrequent)

and that their representations of these words were segmentally detailed. In the new study, English-learning 11-month-olds heard two types of phrases: a function word (*the, his, her, their, its*) paired with a content word, versus a minimally different nonsense functor (*ke, ris, ler, lare, ots*) paired with a content word. The 11-month-olds' looking time showed an emerging recognition of function words as opposed to segmentally modified nonsense functors, in that their performance was intermediate between that of 8-month-olds (no recognition) and 13-month-infants (robust recognition). To ascertain further whether function words facilitate the recognition of an adjacent content word, 11-month-olds were familiarised with a pseudo-content word preceded by an actual functor *the* or *its* (e.g., *the breek*) versus another pseudo-content word preceded by the phonetically similar nonsense functor *ke* or *ots*. After familiarisation the infants were tested on recognition of the two content words presented in isolation. Infants listened significantly longer to the word which had previously co-occurred with *the* as opposed to that with the phonetically similar *ke*, while no difference was observed for the infrequent functor *its* compared to *ots*. The functor *the* is much higher in frequency than the functor *its*; this finding thus suggests that only a highly frequent functor facilitates segmentation of the adjacent content word.

1.1.5 Phonological detail in infants' word learning

Swingley completed a study evaluating 11-month-olds' phonological representations of familiar words. Using an infant-controlled auditory preference procedure, one experiment showed that infants at this age prefer to listen to real words (such as *hond*, 'dog', and *neus* 'nose') relative to phonologically matched nonce words (including *veent* and *noet*). This replicated previous research demonstrating that via natural exposure infants learn the forms of some words well enough to recognize them. A second experiment revealed that this preference was not shown when the real words were slightly mispronounced (as in *meus* for *neus*), implying that infants did not recognize the deviant pronunciations as instances of the words. A third experiment revealed a preference for correct pronunciations over mispronunciations. These findings suggest that infants' lexical representations are phonologically well-specified, at least for the onsets of short words.

1.2 Learning of auditory categories in adulthood

Infant phonological learning contrasts with adult learning, which is also explored within this project, in particular with reference to the usefulness of explicit feedback for the adult learner (1.2.1) and the flexibility of adult listeners' native phoneme categories (1.2.2).

1.2.1 Adult acquisition of phonetic categories

Infants' first steps in language acquisition involve learning language-specific phonetic categories. Infant learners successfully master this formidable task without the assistance of explicit supervision (feedback) or explicit verbal mediation or instruction. Yet for adult learners, feedback and explicit mediation have been shown, in studies of visual categorization, to play an important role in category acquisition. With feedback, adults can learn much more difficult category distinctions than they can learn without feedback; with explicit mediation, success in category learning appears to depend on the dimensionality of the categories. Experiments conducted by Goudbeek, in collaboration with Kluender (U. Wisconsin), attempted to clarify the effects of feedback on auditory category learning. In one series of experiments, two acoustical dimensions - duration and the mean frequency of the spectral peak - were manipulated in creating complex inharmonic nonspeech sounds. In another series, comparable dimensions - duration and the frequency of the first formant - were used in creating synthetic speech stimuli. In both experiments subjects were instructed to learn the category structure by using the feedback provided. Results showed that learning multidimensional auditory categories and subsequently categorizing unfamiliar stimuli according to the acquired distinction is extremely hard, certainly harder than the previous findings from experiments with visual stimuli would have predicted. Results from the training data suggest that subjects do learn and use both dimensions in categorizing the stimuli, but when confronted with a neutral stimulus set (no category structure, no feedback), subjects almost invariably choose a unidimensional solution. The findings were not specific to a given listener population, since similar results were obtained both in initial experiments in Wisconsin and in subsequent experiments in Nijmegen. The Nijmegen experiments, which explored manipulations to improve subjects' performance, revealed that only with fully explicit instructions can subjects adopt a multidimensional solution in the test phase.

1.2.2 Lexical knowledge and category learning

Previous research on adult category learning by McQueen, Cutler and Norris (MRC Cognition and Brain Sciences Unit, Cambridge; see Annual Reports 2001, 2002) showed that phonetic categories are retuned as a consequence of exposure to an artificial 'accent'. When listeners were exposed to speech in which every [s] sound had been replaced by a perceptually ambiguous sound lying midway between [s] and [f] (stimuli such as [na:lɔbo?]; *naalɔbos* is a Dutch word, *naalɔbof* is not), they learned to interpret this ambiguous sound ([?]) in a lexically consistent manner, i.e., as an [s], as measured in subsequent categorisation responses to an [ɛf]—[ɛs] continuum. When another group of

listeners was trained on speech in which every [f] sound had been replaced by the same ambiguous sound [ʔ], perceptual learning led to the opposite effect of interpreting [ʔ] as [f]. A series of experiments in Eisner's Ph.D. project (see also Annual Report 2002) investigated how phonetically detailed this perceptual adjustment is, and whether it will be re-applied talker-specifically or affect processing of another talker's speech. Evidence for perceptual learning after exposure to one female talker's speech was found when the test items were based on the exposure talker's speech, and when the same test fricatives appeared after vowels spoken by a different female or male talker. There was no exposure effect, however, when the test items were made entirely from a novel talker's speech, that is, when both the vowel [ɛ] and the fricative continuum had been produced by a novel male talker. These results suggest that perceptual learning about idiosyncratic speech is applied at a very detailed level (segmental or featural), and that, under the exposure conditions of this series of experiments, the learning is talker-specific.

While Eisner's research has shown that this lexically-guided perceptual learning effect does not generalize across talkers, further research by McQueen, Cutler and Norris has shown that the effect does generalize to novel words spoken by the same talker. In this new experiment, exactly the same exposure conditions were used as in all previous experiments in this series (i.e., stimuli such as *witloʔ*, based on *witlof* 'chicory', or, in the other exposure group, stimuli such as *naaldboʔ*, based on *naaldbos* 'pine forest'). In the test phase, however, the phonetic categorization task was replaced by a cross-modal identity priming task. Participants heard spoken primes, and then made visual lexical decisions to letter strings, presented at the acoustic offset of the primes. The critical materials were 20 minimal pairs such as *doof-doos* 'deaf-box'. Listeners who had received [f]-biased exposure made faster visual lexical decisions to *doof*, for example, after hearing *dooʔ* than after hearing an unrelated prime (e.g., *krop*); they thus appeared to recognize *dooʔ* as *doof*. In contrast, listeners with [s]-biased exposure appeared to recognize *dooʔ* as *doos*: their decisions to *doos* were faster after *dooʔ* than after *krop*. Learning about ambiguous fricatives thus benefits recognition of words not heard during the exposure phase. This generalization effect suggests that the learning process has a prelexical locus: if the learning took place at the lexical level (i.e., via adjustments to the representations of the individual words heard during the exposure phase), or at a postlexical phonemic decision level, learning would not generalize to the processing of new words. These findings therefore challenge models of spoken word recognition in which there is no abstraction of the information in the speech signal before lexical access, that is, models with no prelexical level of processing.

1.3 Native phonology in adult listening

Another continuing interest in the present project concerns the effects on comprehension of phonological differences between languages. For instance, phonemic repertoire constitution affects the listener's task (1.3.1), which in turn can affect the way in which speech is perceived (1.3.2). When the phoneme categories of a non-native language do not correspond to those of the native language, spoken-word recognition in the nonnative language can be adversely affected, as previous research (Annual Report 2001, 2002) has attested; much of this results from inaccurate perception of the non-native categories (1.3.3).

1.3.1 Phonemic repertoire and similarity within the vocabulary

Language-specific differences in the size and distribution of the phonemic repertoire can have implications for the task facing listeners in recognising spoken words. A language with more phonemes will allow shorter words and reduced embedding of short words within longer ones, decreasing the potential for lexical competitors to be spuriously activated by speech signals. Cutler, with Norris and Sebastián-Gallés (U. Barcelona), undertook comparative analyses of the vocabularies of English and Spanish, in order to explore the relationship between phonemic repertoire constitution and similarity between lexical items in the vocabulary. The English analyses were carried out on the English vocabulary of Celex, the Spanish analyses on a newly available phonetically transcribed large database of Spanish. The two languages differ in a number of relevant respects: Spanish has 25 phonemes (20 consonants and five vowels) while English has over 40 (more than 20 of each kind); stress in Spanish has no direct segmental reflection, while in English stressed syllables must have full vowels, and reduced vowels can only be unstressed. The analyses showed that, as expected, words in Spanish (with fewer phonemes at its disposal) tended to be longer than words in English, both in terms of number of phonemes and number of syllables. Further, Spanish words of any given length tended to contain more embedded words than English words of the same length. However, this extensive asymmetry in embedding frequency was only true if stress was disregarded; when stress of an embedded word was required to match stress in the carrier word, the number of embeddings could be reduced by about one-third in English, but by more than two-thirds in Spanish. A language which effectively uses suprasegmental as well as segmental contrasts can thus substantially reduce the extent of spurious embedding within the vocabulary.

1.3.2 Phonemic repertoire and the perception of speech sounds

Wagner continued her research on the effect of size and structure of the native phoneme repertoire on phoneme identification and on listeners' sensitivity to acoustic cues in native and non-native listening. Spanish, which as described

above has relatively few vowels, was compared with Dutch and German, languages with approximately as many vowels as consonants. New phoneme detection experiments with pseudowords pronounced by a Spanish speaker confirmed language-dependent differences in reaction times to vowels and consonants (observed previously with stimuli pronounced by a Dutch speaker; see Annual Report 2002): Spanish listeners, but not Dutch and German listeners, detected vowels faster than consonants. In another experiment, participants heard stimuli where the target segments were surrounded by context which had been manipulated such that acoustic information cueing a following phone either was or was not misleading. Spanish listeners missed many more fricatives preceded by misleading formant transitions, independently of the speaker's language (Dutch or Spanish). Thus, these listeners were relying on the information in vowel-fricative transitions. Dutch and German listeners, however, were not misled by these transitional cues, suggesting that they do not rely on this type of information. A possible explanation is the presence of both labiodental and dental fricatives in Spanish; Dutch and German listeners need not make such distinctions. This hypothesis was tested in an additional experiment with the same stimuli, but now with English native speakers; English also has both types of fricative. The English listeners, too, showed sensitivity to the vowel-fricative formant transitions. These results confirm that vowel-fricative transitions are important cues, but only for listeners who in their native language distinguish between labiodental and dental fricatives. Sensitivity to these cues seems to be acquired with the native language, and this strategy is applied to fricatives in general, and also to speech produced by speakers of another language.

1.3.3 Native phonemic repertoire and non-native phoneme recognition

Weber completed the data collection for the project on non-native perception of English phonemes started by Cooper (see Annual Reports 1999, 2000). In the listening experiments, native listeners of Dutch and American English were asked to categorize the vowels and consonants of all possible American English CV and VC syllables (22 consonants and 15 vowels). Stimuli were embedded in multispeaker babble at 3 signal-to-noise ratios (SNRs): 0, 8, and 16 dB. Smits carried out the first analyses of these data. Averaged over language groups, consonant recognition was found to steadily improve over the three SNRs from 40% to 75% correct. Vowel recognition, on the other hand, remained constant at about 70%, due to ceiling effects. Interestingly, the patterns of consonant and vowel recognition as a function of SNR were the same for the two languages, apart from the American listeners outperforming the Dutch by about 15%. A second analysis focused on the effect of the Dutch devoicing rule on voice perception in coda consonants. Coda obstruents are devoiced in Dutch but

not in English. This phonological pattern raises the question whether Dutch listeners are impaired with respect to the recognition of voice in coda obstruents. The results showed that this is indeed the case: Whereas American listeners were somewhat better at recognizing voice in obstruents in coda than in onset position, the performance of the Dutch was worse for coda than for onset position, the interaction being statistically significant. The proposed explanation of this pattern is that the Dutch listeners have difficulty using the voicing cue encoded in the length of the vowel nucleus.

This explanation draws inter alia on Broersma's studies of the accuracy of Dutch listeners' processing of the voicing distinction in English word-final fricatives. Her previous categorization experiments with stimuli in which vowel length did not vary (see Annual Report 2002) suggested that Dutch listeners do not use the duration of the preceding vowel as much as English listeners do, but instead rely on cues in the signal itself more strongly than native listeners do. In a follow-up study, Dutch and English participants again categorized items from nonword-final /v/-/f/ and /z/-/s/ continua, and again the duration of the preceding vowel was kept constant in each block, corresponding in this case to a voiceless target (in the earlier study the vowel duration had been consistent with the voiced target). For the /v/-/f/ contrast, this difference in vowel duration led to a shift in the categorization curve for the English, but not for the Dutch. For the /z/-/s/ contrast, no effect of vowel duration was found for either group. These results suggest that Dutch listeners base voicing judgements on preceding vowel duration to a lesser extent than English listeners do.

In new experiments with natural stimuli Broersma further examined the two listener groups' processing of voicing distinctions. In these experiments Dutch and English participants made categorization decisions between /b/ and /p/, /d/ and /t/, /z/ and /s/, or /v/ and /f/, in nonword-initial and -final position. Note that all these phoneme pairs exist both in English and in Dutch, but in Dutch the voiced phonemes cannot occur in final position. The plosives in final position were presented in two conditions: fully intact, and with the release burst removed. The Dutch listeners categorized all final pairs as well as (or better than) initial pairs, and their performance was equivalent to that of the English native listeners. The absence of a release burst did not differentially affect the two groups' performance. This suggests that Dutch listeners must be able to exploit other cues to voicing, be these in vowel duration or some further acoustic property. In the same study, listeners also categorized /ε/-/ae/, a vowel distinction which does not exist in Dutch. Although the Dutch listeners performed amply above chance, their performance was here significantly below that of the English listeners.

Finally, Dutch listeners' processing of English phonemes was also examined in an undergraduate thesis conducted within this project by Kolkman (U. Amsterdam). In her study, participants heard lists of isolated real English words, and responded with a button press whenever they heard an occurrence of a specified phoneme target. The target could be either one of two vowels or one of the four stop consonants /p/, /t/, /b/ and /d/, and all targets could occur in word-initial, -medial or -final position. Response times were fastest to word-final and slowest to word-initial targets, suggesting a strong effect of lexical knowledge on responses, as listeners heard enough of the word to recognize it. In later positions in the word, response time was also slower for vowels than for consonants. Crucially, however, there was no indication that the Dutch listeners were disadvantaged in responding to voiced targets in word-final position, as would have been the case had their native phonology (which disallows voiced stops in final position) affected their processing of the English words. Their response times were in fact faster to voiced than to voiceless targets in all positions in the word, with the voiced advantage if anything greatest rather than least in word-final position. Comparison data from English listeners was collected for Kolkman's materials by Broersma; this data set showed a similar response pattern in nearly all respects for the native as for the Dutch listeners. The non-native listeners were also not slower in this task than the native listeners. These data are consistent with the conclusion motivated by Broersma's categorization study, that Dutch listeners can indeed exploit acoustic cues to English voicing distinctions. Thus the fact that Dutch listeners (but not English listeners) often overlooked word-final voicing distinctions in a lexical decision task, and accordingly accepted nonwords such as *cheece* as real English words (Annual Report 2001), should not be ascribed to simple inability to perceive acoustic cues in English speech.

2 DECODING CONTINUOUS SPEECH

Introduction

- 2.1 Decoding segmental information
- 2.2 Decoding suprasegmental information
- 2.3 Lexical decoding

Participants:

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Delphine Dahan (U. Pennsylvania)	Natasha Warner (U. Arizona)
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Joint research with other projects:

Phonological Learning for Speech Perception
Utterance Encoding

As its name implies, the Decoding Continuous Speech Project examines how listeners crack the speech code, that is, how they extract speakers' messages from the acoustic information in spoken utterances. The mental lexicon must play a central role in this process, since it is only via contact with stored lexical knowledge that the listener can build an utterance interpretation out of the information in the physical speech signal. In the process of mapping speech onto the lexicon, listeners must extract both segmental information (that which allows discrimination among different speech sounds) and suprasegmental information (that which specifies prosodic and intonational structure). Work on these two topics is covered in sections 2.1 and 2.2. Section 2.3 covers various lines of research on the lexical decoding process.

Personnel changed considerably in 2003. In May, Elizabeth Johnson joined the project. She is working on the role of suprasegmental information in speech decoding. In June, Dahan left to take up an assistant professorship (U. Pennsylvania). In August, van Alphen completed her Ph.D. dissertation on the perceptual relevance of prevoicing in Dutch initial plosives. She successfully defended her dissertation in February 2004. In September, Holger Mitterer joined the project. He is working on phonological processing in speech perception, using EEG techniques. In October, Salverda left to take up a postdoctoral research position (U. York).

2.1 Decoding segmental information

The project has continued to examine how listeners extract information about speech sounds. Specific subprojects include further analyses of data on phonetic perception in Dutch (section 2.1.1) and research on phoneme recognition in Korean (section 2.1.2). These studies suggest that components of the speech signal vary in their perceptual salience. Some types of information become available to listeners earlier than other types, and some carry more weight in perception. Other research has been computational (section 2.1.3): a new version of the Shortlist model (Norris 1994) has been built which recognizes words given the physical speech signal as input.

2.1.1 Phonological effects on the perception of gated Dutch diphones

Smits, Warner (U. Arizona), McQueen and Cutler continued their analyses of the project's very large database on speech perception in Dutch (<http://www.mpi.nl/world/dcsp/diphones>; see Annual Reports 1999-2002). This database contains listeners' phonetic categorizations of all 1,179 diphones of Dutch, gated at six points during each diphone. The new analyses investigated the recognition of phonological features as the speech signal unfolds. For consonants, recognition

of manner of articulation was most robust, closely followed by place of articulation, whereas voicing was recognized worst. This pattern is in sharp contrast to earlier studies for American English consonants in noise. For vowels, height and backness were recognized much more reliably than length. Vowel length was only reliably recognized when the entire vowel was audible. Length may be relatively more confusable because the Dutch vowel inventory contains several long-short pairs and diphthongs. The data were also analyzed for effects of stress and of phonological context (neighboring vowel versus consonant); effects of these factors were observed to be surprisingly limited. Finally, statistical effects, such as overall phoneme frequency and transitional probabilities, along with response biases, were examined; these too exercised only limited effects on response patterns. The combined results suggest high levels of listener accuracy in speech perception on the basis of acoustic information alone.

2.1.2 Place assimilation and cluster simplification in Korean

Some phonological patterns are claimed to be best explained by the acoustic/perceptual characteristics of segments. For example, cross-linguistically, alveolars tend to undergo place assimilation more often than labials, which in turn are more susceptible to place assimilation than velars. This asymmetry can be accounted for by a listener-oriented production hypothesis: speakers make a greater effort to preserve perceptually stronger segments than perceptually weaker segments (e.g., velars versus alveolars), and listeners benefit from this. This phenomenon is also seen in tri-consonantal cluster simplification in Korean: for a C1C2C3 sequence, when C2 is optionally deleted, speakers delete /t/ most often and /k/ least often. Cho has previously hypothesized that /k/ is preserved more often because it is perceptually more salient than /t/. In order to evaluate these claims, Cho and McQueen have carried out a series of phoneme monitoring experiments in Korean.

In the first experiment, Korean listeners had to monitor for *underlying* coda targets in either assimilated word forms (/t/ or /p/ → [k]/_k; i.e., where the target was not present in the surface form) or unassimilated word forms (where the target was preserved). If listeners benefit more from the preservation of labials than that of alveolars, the recognition of unassimilated labials should be facilitated (relative to that of assimilated labials) more than the recognition of unassimilated alveolars (relative to that of assimilated alveolars). This hypothesis was confirmed: recognition of unassimilated targets was faster and more accurate than recognition of assimilated targets when the targets were labials,

but not when the targets were alveolars. In the second experiment, listeners again had to monitor for underlying coda targets, but this time either in *illegally* assimilated word forms (/p/ or /k/ → *[t]/_t) or in unassimilated word forms. If velars are perceptually more salient than labials, the loss of velars due to illegal assimilation should be more harmful to listeners than the loss of labials. The results indeed showed that it was significantly harder for listeners to detect illegally assimilated velars than illegally assimilated labials.

The third experiment examined cluster simplification. The cluster $C_1C_2C_3$ was simplified by deleting either C_1 or C_2 . Listeners had to monitor for C_2 either when C_2 was preserved ($\{C_1\}C_2C_3$, '{ }'=a deleted phoneme) or when C_2 was deleted ($C_1\{C_2\}C_3$). The results showed that monitoring latencies were shorter when C_2 was preserved than when it was deleted, but also that this difference was significantly larger when the C_2 targets were velars than when they were labials. This finding reinforces the hypothesis that listeners benefit more from the preservation of velars than that of labials. Overall, these results suggest that asymmetries in place assimilation and consonant cluster simplification in Korean are indeed perceptually grounded, in line with the hypothesized perceptual salience ranking: velars > labials > alveolars. It appears that the speech recognition system is sensitive to the acoustic/perceptual properties of individual segments to differing degrees. This in turn may account for some phonological alternations.

2.1.3 Modeling speech recognition using automatic speech recognition paradigms

Scharenborg (U. Nijmegen) is working on a Ph.D. project which bridges the long-existing gap between the fields of human speech recognition (HSR) and automatic speech recognition by machines (ASR). Virtually all computational models of HSR lack a module that converts the physical speech signal into a symbolic representation, and no fully implemented model exists that can recognize words from the physical signal. HSR models instead tend to operate at a more abstract level. This makes it difficult to determine whether the assumptions they make are consistent with those that would be required in a system that recognizes words given real speech input. Scharenborg, in collaboration with McQueen, Norris (MRC Cognition and Brain Sciences Unit, Cambridge), ten Bosch and Boves (U. Nijmegen), therefore developed a model based on the combination of an automatic phone recognizer (APR from ASR) and Shortlist. The APR+Shortlist model takes an acoustic speech file as input and calculates the activation flow of candidate words on the basis of their degree of fit with the input.

Simulations with this model using spontaneous speech input highlighted critical limitations in some of the assumptions made in Shortlist. In particular, they confirmed that the simplifying assumption of a discrete phonemic input to the word recognition process can not be maintained. Whereas phoneme substitutions led to only moderate deterioration of word recognition, phoneme insertions and deletions, which occurred frequently in the input, severely damaged the model's performance. Scharenborg therefore built a new implementation of Shortlist, called SpeM, using dynamic programming techniques that are common in ASR. Simulations with SpeM showed that it is better able to deal with real speech input than the APR+Shortlist model. Further simulations showed that SpeM performs well in the recognition of lexically ambiguous input. These simulations also showed that the model is able to operate in the same optimal way as human listeners.

2.2 Decoding suprasegmental information

A major focus of the project in 2003 has been on the role of prosodic structure in speech comprehension. Some research has involved detailed acoustic-phonetic analysis of the phonetic signatures of prosodic structure (in German and English; sections 2.2.1 and 2.2.2); this will pave the way for future comprehension studies. Other research (in English and Dutch; sections 2.2.3, 2.2.4 and 2.2.5) has examined the use of suprasegmental information in listening experiments. These studies demonstrate that listeners use a variety of fine-grained acoustic cues to suprasegmental structure during continuous speech recognition.

2.2.1 Effects of prosodic structure on speech sounds: fricative assimilation in German

Kuzla's Ph.D. project is an investigation of the influence of prosodic structure on speech production and perception in German. Other studies in other languages have shown that, within a given prosodic domain, initial segments are produced more strongly than medial ones. This phenomenon is known as domain-initial strengthening. This effect is cumulative in that segments that are initial in larger prosodic domains (phrases) are stronger than those in smaller domains (prosodic words). The phonetic correlates of domain-initial strengthening have been found in measures such as duration, VOT, and amount of articulatory contact. Kuzla's first production experiment examined the variation of initial fricatives, as a function of prosodic boundary size. Little was previously known about prosodically-conditioned variation in fricatives, since most earlier studies were concerned with plosives. Kuzla also investigated how a phonological

process is constrained by prosodic structure. The process under study was voicing assimilation: in German, voiced fricatives assimilate to preceding voiceless obstruents across word boundaries (e.g., $z \rightarrow s/t\#_$).

Acoustic measures showed that the realization of /f,v,z/ is indeed systematically influenced by prosodic structure. First, domain-initial segments were longer in duration at larger prosodic boundaries. Second, voiced fricatives underwent greater voicing assimilation across smaller than larger boundaries. Finally, the degree of voicing assimilation was smaller for /v/ than for /z/. In German, /z/ occurs word initially, but its voiceless counterpart /s/ does not. In contrast, /v/ co-occurs with its voiceless counterpart /f/ in word-initial position. The results thus suggest that, when there is a phonological opposition to be maintained (/v/ versus /f/), prosodically-conditioned assimilation is suppressed. Therefore, in addition to providing further evidence of domain-initial strengthening, this study also demonstrates that prosodic structure influences phonological processes as well as low-level phonetic realizations. Moreover, the effect on the assimilation process appears to be modulated by the phonotactics of the speaker's language.

2.2.2 Enhancement of phonological features

Cho continued to explore the relationship between prosodic strengthening (spatial and/or temporal expansion of articulation due to accent and/or prosodic boundaries; see section 2.2.1) and enhancement of phonological features (see Annual Report 2002). The effects of accent and prosodic boundaries on production of two English peripheral vowels (/a,i/) were investigated through examination of acoustic vowel formants. The results demonstrated that prosodic strengthening differed in kind depending on prosodic positions (in accented syllables versus at edges of prosodic domains). For example, when accented, /i/ was further forward in the acoustic vowel space (enhancing the feature [-back]), but, at edges of prosodic domains (especially domain-finally), /i/ was not necessarily more anterior, but was higher (enhancing [+high]). These findings imply that prosodic strengthening manifested in fine-grained phonetic detail is not simply a low-level phonetic event but instead is a complex linguistic phenomenon, closely linked to enhancement of phonological features.

2.2.3 The role of domain-initial strengthening in segmentation

Cho and McQueen continued their investigation of how the acoustic manifestation of prosodic strengthening influences lexical segmentation in American English (see Annual Report 2002). Their previous work consisted of two cross-modal identity-priming experiments. Listeners heard sentences and

made lexical decisions to letter strings that were presented during the sentences at the onset of the second word in critical two-word sequences. Three factors were manipulated: sentence type (either no Intonational Phrase (IP) boundary or an IP boundary in the two-word sequence); splicing (whether the onset of the sequence's second word was spliced from IP-initial or IP-medial position); and relatedness (whether the visual target was the first word in the sequence or an unrelated word). For the no-IP-boundary sentence type, lexical decisions (e.g., to *bus*, while hearing *bus # tickets*) were faster, relative to the unrelated condition, when the onset of the second word (*tickets*) contained the acoustic properties of domain-initial strengthening (i.e., when it was spliced from IP-initial position).

In two new experiments, in collaboration with Cox (U. Arizona), the materials and design were identical, except that the second words in the sequences (e.g., *tickets*) were used as visual targets. There was no robust effect of domain-initial strengthening on the recognition of these words. This null result, however, is not incompatible with the earlier results, and, taken together, these findings help to specify the role that domain-initial strengthening plays in lexical segmentation. The strengthening of the initial syllable of the domain-initial word (e.g., of the [tɪ] in *tickets*) may increase the bottom-up support for that word, but also, to an equal extent, that for other words beginning in the same way (e.g., *tickle*). Thus, strengthening does not differentially benefit the recognition of domain-initial target words. In contrast, however, strengthening does assist in the recognition of the domain-final word (e.g., *bus*), because it acts to disambiguate the sequence (in all critical sequences, the first word plus the onset of the second word was always compatible with another word; e.g., *bust* in *bus tickets*). Domain initial strengthening therefore appears to modulate lexical segmentation when it can be used to resolve a lexical ambiguity involving the placement of a word boundary (e.g., *bus* versus *bust*). Overall, this study suggests that the fine-grained phonetic manifestation of prosodic boundaries aids listeners in lexical segmentation. It appears that speakers signal prosodic structure via systematic phonetic details, and listeners use these cues to prosodic structure in decoding continuous speech.

2.2.4 Segmenting continuous Dutch: the role of suprasegmental durational cues

Shatzman's Ph.D. project also examines how listeners use suprasegmental fine phonetic detail in lexical segmentation. She has conducted eye-tracking experiments with lexically ambiguous Dutch materials. Subjects were presented with a set of pictures on a computer screen. Their eye movements to the displayed pictures were monitored as they listened to short sentences. They were instructed to move the picture that was mentioned in the sentence. The target words – twenty stop-initial picturable nouns (e.g., *pot* 'jar') – were selected such that the addition of an initial /s/ to each word would result in another noun (e.g., *spot* 'mockery'). The sentences were constructed such that a lexical ambiguity occurred. For example, the sentence *Ze heeft wel eens pot gezegd* ('She said once pot') might be interpreted as containing the word *spot*. Two versions of each sentence were created, in which the target word and the preceding /s/ were either replaced by the cluster-initial word, or by the target word and preceding /s/ from another recording of the sentence.

Subjects made fewer fixations to the target pictures when the sentences contained the cluster-initial words, indicating that, although the two versions were phonemically identical, subjects were sensitive to fine-grained information in the stimuli. Further analyses showed that the two versions differed in various acoustic measures. However, only one factor – the duration of the /s/ – correlated with the size of the effect. That is, the /s/ in cluster-initial position was longer than the /s/ in the final position of *eens*, and the bigger the difference between the two, the larger the effect was in the eye-tracking experiment. A follow-up study showed that manipulating the duration of the /s/ alone can bias subjects' interpretation of the ambiguous sequence. Thus, in this context, the /s/ duration information is an important factor guiding word recognition.

2.2.5 The effect of a word's position in an utterance on lexical interpretation

Salverda continued his Ph.D. research on the influence of prosodic structure on spoken-word recognition, in part supported by a visiting scholarship (U. Rochester) in 2002. In collaboration with Tanenhaus, Crosswhite, Masharov and McDonough (U. Rochester), he examined the recognition of English words in different prosodically-defined positions in utterance contexts. Monosyllabic and polysyllabic target words (e.g., *cap* and *captain*) were presented in instructions that mentioned the target in utterance-medial position (e.g., *Put the cap next to the square*) or utterance-final position (e.g., *Now click on the cap*). In

accordance with utterance-final lengthening, the duration of the monosyllables was longer utterance-finally than utterance-medially, whereas the duration of the initial sounds of the polysyllables hardly varied as a function of position.

The impact of the position of the targets in the instructions on the activation of competitor words was examined in an eye-tracking experiment. The instructions were presented at the same time as a visual display with four pictures, including a picture of the target and a picture of a monosyllabic or polysyllabic competitor. When monosyllabic words (e.g., *cap*) were targets, there were *fewer* fixations to polysyllabic competitors (e.g., *captain*) when targets appeared in utterance-final position than when they appeared in utterance-medial position. Conversely, there were *more* fixations to monosyllabic competitors (e.g., *cat*) when monosyllabic targets appeared utterance finally than when they appeared utterance medially. When polysyllabic words such as *captain* were targets, however, the proportion of fixations to monosyllabic competitors (e.g., *cap*) was not influenced by the target word's position. These findings extend Salverda's previous research (see Annual Report 2000, 2001) by demonstrating that lexical interpretation is sensitive to prosodically-conditioned variation associated with a word's position in an utterance. The influence of this variation on lexical interpretation reflects the differential impact of final lengthening on the production of monosyllabic and polysyllabic words.

2.3 Lexical decoding

The research summarized in sections 2.1 and 2.2 has repeatedly shown that speech decoding is sensitive to subtle phonetic detail. This sensitivity also has consequences for processing at the lexical level, in particular with respect to the effect of a word's morphological paradigm on word recognition (sections 2.3.1 and 2.3.2). Further research on lexical decoding has been concerned with the relationship between phonological and conceptual representations in the lexicon (section 2.3.3). Finally, a meta-analysis of neuroscientific data on speech comprehension has been carried out (section 2.3.4).

2.3.1 Incomplete neutralization in morphological paradigms

In Dutch, as in many other languages, voiced obstruents are devoiced in syllable-final position. Earlier research has shown that final devoicing is phonetically incomplete (underlyingly voiced obstruents are realized as slightly voiced), and that listeners take advantage of this incomplete neutralization. Ernestus, in collaboration with Baayen (U. Nijmegen/IWTS) continued her research on the relative roles of incomplete neutralization and lexical analogy in word recognition (see Annual Report 2002).

A speaker of Dutch recorded two versions of obstruent-final words. In one version, the final obstruent was correctly realized as voiceless (e.g., [mant] 'basket'). In the other, it was incorrectly realized as voiced ([mand]). Acoustic analyses revealed that the voiceless plosives that were underlyingly voiced had shorter release noises than those that were underlyingly voiceless, a hallmark of incomplete neutralization. In the first experiment, listeners heard either the complete word (e.g., [mant], [mand]) or its final rhyme ([ant], [and]). They were asked to rate the voicing of the obstruents on a five-point scale. Participants who heard complete words scored the voiceless plosives that were underlyingly voiced as more voiced than did the participants who listened to final rhymes. Listeners thus based their judgments at least in part on lexical information.

There is no straightforward way of incorporating incomplete neutralization in a formal phonological account. Ernestus and Baayen have therefore proposed a paradigmatic approach. Their hypothesis is that the forms in a word's inflectional paradigm are co-activated when that word is spoken or heard. If a word's paradigm contains forms with a voiced allophone for the stem-final obstruent, this co-activation leads to support for a voiced realization of this obstruent. In production, this causes incomplete neutralization, while in perception, as for example in the above rating experiment, it leads to higher voicing ratings.

The words from the rating experiment were then used in a lexical decision experiment. Listeners were instructed to give yes-responses to real words and to those words that were incorrectly realized with a voiced final obstruent ([mand]). Listeners reacted more slowly to these incorrect forms than to the correct forms. This shows that acoustic realizations which perfectly match the abstract underlying representations assumed in generative phonology inhibit word comprehension if they do not match surface representations. Interestingly, the delay caused by an incorrect realization was smaller when the final obstruent had voiced allophones in the paradigm of its carrier word (i.e., was underlyingly voiced). Crucially, however, the higher the frequency of the inflectionally related forms with the voiced obstruent compared to the frequency of the forms with the voiceless allophone, the slower participants reacted to a form ending in a voiceless obstruent. This relative frequency effect suggests that, within the inflectional paradigm, the forms with the voiced allophone are in competition with those with the voiceless allophone.

Finally, in a third experiment, listeners made lexical decisions on two other versions of each word: one with a completely voiceless final obstruent, and one with a slightly voiced final obstruent. This experiment showed that the competition between the paradigm members with the voiced allophone and those with the voiceless allophone, as expressed in relative frequency effects, was larger when the final obstruent was realized as slightly voiced. Slightly voiced obstruents are more similar to fully voiced obstruents, and therefore lead to more co-activation of the members with voiced allophones in the paradigm. This suggests that incomplete neutralization, which is most prominently present in careful speech, is in fact dysfunctional for the listener.

2.3.2 Fine-grained durational cues in morphological processing

Ernestus also investigated the role of fine-grained phonetic cues and paradigmatic analogy in another series of experiments, this time in collaboration with Kemps, Baayen, Schreuder (U. Nijmegen/IWTS) and Wurm (Wayne State U.). In stress-timed languages, stems are shortened when they are followed by affixes containing unstressed vowels; the length of a stem thus provides information about its morphological structure. In lexical decision experiments in English and Dutch, listeners showed sensitivity to this durational information. Listeners' responses were slower when this information did not match the words' morphological structure. Importantly, Dutch listeners were sensitive to the relative frequency of unstressed suffixation (i.e., the ratio of the frequencies with which a stem either is followed by affixes with unstressed vowels or is not). This finding provides further support for the hypothesis that co-activation within the inflectional paradigm co-determines comprehension. Frequency of affixation did not affect the English response latencies, possibly because suffixes with unstressed vowels are less common in English.

2.3.3 The lexical representation of Dutch homophones

Cutler and Ernestus investigated the relation between phonological and conceptual representations in a cross-modal priming study of homophones (single phonological representations with multiple conceptual representations, such as *sale/sail*). Dutch homophones such as *pijl* ('arrow', homophonic with *peil* 'gauge') were presented as visual targets for lexical decision, preceded by spoken primes which were either identical (i.e., in this case, read as *pijl* from a list), the homophone (read as *peil* from a list), or a control word. Responses were significantly faster after either related prime than after the control prime. The response latencies after either related prime, however, could be predicted from the ratio of the token frequency of the target word itself to the token

frequency of the other member of the homophonic pair. Especially those participants with overall slower responses showed faster reactions when this ratio was greater. A possible interpretation of this result is that a single phonological representation activated (eventually) multiple conceptual representations, with competition between those representations being affected by relative conceptual frequency.

2.3.4 Meta-analysis of imaging studies on passive speech comprehension

Indefrey and Cutler conducted a meta-analysis of hemodynamic studies on passive auditory language processing. They assessed the overlap of hemodynamic activation areas and activation maxima reported in experiments involving the presentation of sentences, words, pseudowords, or sublexical or nonlinguistic auditory stimuli. Areas that have been observed to be reliably active across replication studies were identified. The findings suggest that auditory language input is processed in a left posterior frontal and bilateral temporal cortical network. Within this network, no processing level is related to a single cortical area. The temporal lobes seem to differ with respect to their involvement in postlexical processing, in that the left temporal lobe has greater involvement than the right, and also in the degree of anatomical specialization for phonological, lexical, and sentence-level processing, with greater overlap on the right contrasting with a higher degree of differentiation on the left.

3 UTTERANCE ENCODING

Introduction

- 3.1 Single word utterances
- 3.2 Multiple word utterances

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Joint research with other projects:

Decoding Continuous Speech

The Utterance Encoding Project examines how speakers express ideas in speech. Various aspects of this process, such as conceptualization, linearization, grammatical encoding, form encoding, self-monitoring, and gesturing during speech have been topics of research in previous years. The ability to produce single words is a crucial subcomponent to the process of producing larger utterances. Both single- and multiple-word utterances have been central research topics in the past few years and continued to be the primary foci of attention in 2003.

3.1 Single word utterances

Over the past 15 years, a theory of single word production has been developed within the project (for an overview, see Levelt 2001). The theory has been computationally implemented in a model called WEAVER++. According to the theory, word planning proceeds from conceptual preparation via lemma retrieval to word-form encoding and syllabary access.

3.1.1 Lemma competition between proper and common nouns

Earlier research in the project (Annual Report 2000:28) has shown that semantic interference effects in object naming can be induced by a semantic blocking procedure in which pictured objects are presented for a naming response in the context of other objects from either the same semantic category (homogeneous blocks) or a different semantic category (heterogeneous blocks). Objects were named slower in the semantically homogeneous condition than in the semantically heterogeneous condition, a finding that is assumed to reflect lemma competition in speech production.

Abdel Rahman and Damian (U. Bristol) tested whether semantic blocking effects can also be observed for the naming of familiar faces. The naming of faces can be viewed as a special case of object naming, but semantic interference effects in face naming have rarely been reported. In a first experiment, faces of famous people from five different semantic categories (actors, politicians, athletes, musicians, and royals) were presented in semantically homogeneous or heterogeneous blocks of trials. The results showed a semantic blocking effect comparable to the one observed for object naming. That is, familiar people were named slower when they were presented in the context of other people from the same semantic category than when they were presented in the context of other people from a different semantic category. This finding suggests that proper names are subject to lemma competition in a similar way as common names.

A second experiment tested whether semantic blocking effects persist across different lexical domains. The basic paradigm was extended by the combined presentation of faces and objects in each block of trials. Participants produced the proper and common nouns under four conditions: (1) when both faces and objects belonged to the same semantic category (e.g., Prince Charles, throne, crown, Queen Beatrix, etc.), (2) when faces but not objects belonged to the same semantic category (e.g., Prince Charles, microphone, bicycle, Queen Beatrix, etc.), or (3) vice versa (e.g., George Clooney, throne, crown, Nelson Mandela), or (4) when the two types of stimuli belonged to different semantic categories (e.g., George Clooney, bicycle, guitar, Prince Charles). Both faces and objects were named significantly slower in the purely homogeneous blocks as compared to the purely heterogeneous blocks. However, the results also showed that the effects were domain-specific. Semantic blocking affected the naming latencies within but not across lexical domains. Furthermore, within-domain blocking was sufficient to induce interference effects irrespective of whether the stimuli of the other domain belonged to the same or different semantic categories. Because a control experiment with manual classifications showed between-domain effects of semantic relatedness, these results suggest that lemma competition might be confined to items within a given lexical domain such as proper nouns or common nouns.

3.1.2 Processing of syntactic features

Schiller continued his work on the processing of gender information in speech production (Annual Report 2002:31). Earlier research showed that semantic and phonological factors can influence decisions about the syntactic gender of nouns in comprehension (Schiller et al. 2003). In collaboration with Schwichtenberg (U. Osnabrück/UCSD), Schiller investigated the role of semantic category membership on gender assignment. In German, certain semantic categories are associated with a preferred gender, e.g., predators are predominantly masculine, whereas insects are predominantly feminine. When native German participants were presented with a semantic category (e.g., *Raubtier*, "predator") and a pair of pseudowords marked for syntactic gender by a preceding determiner (e.g., *der*_{mas} *Trelle* versus *die*_{fem} *Stisse*), participants preferentially judged the pseudoword preceded by the gender-marked determiner associated with the category (e.g., *der*, masculine) to be a more likely category member (e.g., a predator). Pseudowords were controlled for phonological gender cues. Furthermore, participants were also faster to select the gender-congruent member of a pair than the gender-incongruent one. Interestingly, for categories without any gender preference, such as body parts, no gender selection preference was observed. These findings suggest that

semantic regularities might be part of the gender assignment system of native German speakers. Although these data do not answer the question of whether or not gender assignment regularities are used in on-line speech production, they do suggest that these regularities are part of the organizing principles of the lexicon. Future research will need to show how gender assignment regularities might influence speaking.

3.1.3 Task mixing and the dynamics of information retrieval

Abdel Rahman and Melinger (Saarland U.) developed a selective task mixing procedure to investigate the relations between different processing components involved in speech production. In a series of experiments, participants classified Dutch translations of visually presented English words according to a syntactic feature (grammatical gender: neuter versus nonneuter) and a phonological feature (second phoneme: vowel versus consonant). In the baseline condition the two classification tasks were carried out in random alternation, whereby the color of the presented words indicated the task to be carried out. Classification latencies in this condition were compared with a mixed condition, in which a third task was introduced that was either an additional syntactic classification (Experiment 1) or an additional phonological classification (Experiment 2). The critical question was whether the nature of the additional classification task modulated the mixing costs on tasks that required the retrieval of syntactic or phonological information, respectively.

In Experiment 1, the introduction of an additional syntactic task affected both the syntactic and the phonological classification, although the magnitude of the mixing costs was substantially reduced for the phonological relative to the syntactic classification. In contrast, the introduction of an additional phonological task in Experiment 2 affected only the phonological classification but not the syntactic classification. Preliminary data of a control experiment confirmed that the differential task mixing effects obtained in Experiments 1 and 2 depended on the nature of the information retrieved: when all three tasks required the retrieval of the same type of information (e.g., phonological information), symmetrical mixing costs were observed. Overall, the results suggest that syntactic factors (syntactic task mixing) can affect phonological processing whereas phonological factors (phonological task mixing) have no such influence on syntactic processing. The differential modulation of mixing costs as a function of the specific type of information retrieved shows that this paradigm can be used to investigate interactions between distinct processing components in speech production.

3.1.4 Morpheme frequency

After a lemma has been selected for a lexical concept, the appropriate word form needs to be encoded. According to WEAVER++, this involves encoding the word's morphological structure and generating its phonological and phonetic forms. Morphological encoding involves retrieving one or more morphemes and serially ordering them. This encoding process is the topic of a new Ph.D. project by Heidrun Bien, supervised by Baayen and Levelt.

Bien set out to examine the role of morpheme frequency in production latencies. Using the position-response association task developed by Cholin (Annual Report 2002:30), she measured production latencies of transparent Dutch N-N compounds to disentangle effects of morpheme frequency and word frequency. Morphologically complex words may differ in the frequency of the whole word and in the frequency of the constituting morphemes. Participants had to produce N-N compounds that were matched for their whole-word frequency but differed in the frequency (high versus low) of the first and second morpheme. The frequency of both the first and the second morpheme affected production latencies.

3.1.5 Time course of phonological encoding

Schiller continued his work on the time course of computing phonological words by using verbal monitoring tasks (Annual Report 2002:28). Earlier research by Schiller and colleagues 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++. Together with Vroomen (U. Nijmegen), Schiller employed the English-Dutch translation naming task introduced by Wheeldon and Levelt (1995) to investigate the role of lexical stress in segmental encoding. Since phonological words are completely prosodified, stress should play a role in the self-monitoring of segments. English-Dutch bilingual participants were required to monitor for segments in Dutch target words elicited by English prompt words. Target words had either initial stress (e.g., *kermis*, 'fair') or final stress (e.g., *fornuis*, 'oven').

The results revealed a significant increase in monitoring times between the first and the second consonant in target words with initial stress (e.g., between the /k/ and /r/ of *kermis*), but not in targets with final stress (e.g., between the /f/ and /r/ of *fornuis*). However, with final stress there was a significant increase in monitoring latencies from the second to the third consonant (between the /r/ and /n/ of *fornuis*), whereas this was not the case with initial stress (between the /r/ and /m/ of *kermis*). The encoding of lexical stress during phonological word formation takes time, thus delaying the monitoring of target consonants.

This accounts for the increase in monitoring latencies from the first to the second target consonant seen for words with initial stress, which was not observed for words with final stress. Furthermore, the computation of syllable boundaries presumably also takes time. This may explain the increase in monitoring latencies from the second to the third target consonant for words with final stress. The absence of this effect for words with initial stress may be due to the fact that encoding of the second target consonant was already delayed due to the encoding of lexical stress. Finally, the absence of a difference in monitoring times for consonant targets in the second syllable for both types of words agrees with previous findings in the project. These results support the hypothesis that encoding of later segments occur at a faster rate because segments presumably continue to become available at a steady rate, but can only be inserted into the phonological word after syllable boundaries and lexical stress have been computed (Wheeldon & Levelt 1995).

3.1.6 Phonological versus phonetic syllables

WEAVER++ implements the claim that the on-line construction of phonological syllables is followed by access of ready-made syllable motor programs from a mental syllabary. The model predicts that it should be possible to prepare phonological syllables when they are known in advance (e.g., Annual Report 2002:29). In a preparation experiment, utterances are produced in homogeneous blocks of trials where they share part of their form (e.g., the first segment or first syllable) and in heterogeneous blocks of trials where they share nothing of their form in common. The difference in production latency between homogeneous blocks and heterogeneous blocks is called the preparation effect. Furthermore, according to the model, accessing the syllabary should yield effects of syllable frequency. Moreover, because low-frequency phonetic syllables take longer to access from the syllabary than high-frequency ones, they should yield a larger gain when prepared. These predictions were confirmed in the Ph.D. research by Cholin, supervised by Schiller and Levelt. Using the form-preparation paradigm, she observed that nonwords with high-frequency syllables were produced faster than nonwords with low-frequency syllables, supporting the existence of a mental syllabary. Moreover, she observed that when syllable frequency and form overlap were manipulated simultaneously, low-frequency syllables yielded a larger preparation benefit than high-frequency syllables.

3.1.7 Modeling of word-form encoding in Mandarin Chinese

The WEAVER++ model has been developed to account for form encoding processes in languages such as Dutch and English. However, it is important to examine whether or not the model can also account for word-form encoding in

languages that are very different from Dutch and English. One such language is Mandarin Chinese. Unlike Dutch, Mandarin Chinese is a tone language. Moreover, Mandarin Chinese has far fewer syllable types than Dutch and there is no resyllabification, making the storage of phonological syllables in the mental lexicon an attractive option (for Dutch, WEAVER++ computes phonological syllables on-line). In support of stored phonological syllables, syllable exchange errors occur in Mandarin Chinese but not in Dutch. Also, in contrast to the results obtained in Dutch and English by Schiller (Annual Report 2000:33), syllable priming effects have been obtained in Mandarin Chinese.

Using the preparation paradigm described in the previous section (3.1.6), several aspects of word-form encoding in Mandarin Chinese have been examined in experiments by J.-Y. Chen and colleagues (2000). Advance knowledge of syllables plus their tones yielded the largest preparation effects, but preparing syllables alone also yielded some facilitation. Segments and tones alone could not be prepared.

In a new Ph.D. project supervised by J.-Y. Chen (National Chung-Cheng U., Taiwan) and Roelofs, T.-M. Chen implemented two Mandarin Chinese versions of WEAVER++. One version computed phonological syllables online whereas the other version possessed stored phonological syllables. Computer simulations revealed that the stored version best accounted for the empirical findings on Mandarin Chinese. Although both models could account for the available data on Mandarin Chinese, the on-line model predicted an additional preparation effect for single segments that was not present in the behavioral data. Thus, the simulations favor the view of stored phonological syllables over computed phonological syllables for Mandarin Chinese.

3.1.8 Relationship between spoken word production and comprehension

In a new Ph.D. project supervised by Roelofs and Levelt, Rebecca Gross examined the relationship between spoken word production and recognition. In a first study, participants had to (1) name pictures, (2) determine whether the pictured entity was animate or not, and (3) determine the gender of the picture name (neuter versus nonneuter). Trials were blocked by task. All pictures had monosyllabic names. While performing these tasks, the participants heard spoken distractor words that were phonologically related or unrelated to the picture name. The relatedness concerned the beginning or end of the word. The spoken distractor words were presented at different stimulus onset asynchronies (SOAs). The onset of the spoken word was presented in three different conditions: 150 ms before the onset of the picture presentation (SOA = -150 ms), at the onset of the picture presentation (SOA = 0 ms), or 150 ms after the

onset of the picture presentation (SOA = 150 ms).

Phonological relatedness speeded up the naming of the pictures but it had no effect on the animacy classifications and gender decisions. This suggests that the phonological facilitation arises during word-form encoding rather than lemma retrieval or conceptual identification. Moreover, the onset of the phonological facilitation was at SOA = -150 ms for end-relatedness, whereas it was at SOA = 0 ms for the begin-relatedness. At SOA = 0 ms and 150 ms, the effects of begin- and end-relatedness effect did not differ.

These results support the existence of lexical and sublexical form connections running from word comprehension to word production. The lexical connections explain the earlier onset of facilitation for end- than for begin-relatedness: the begin- but not the end-related spoken distractors are cohort competitors of the picture name. The sublexical connections explain the absence of a difference between begin- and end-relatedness at the later SOAs.

A second study examined the influence of spoken word production on comprehension. Participants had to name pictures except when they heard a spoken word presented 300 or 600 ms after picture onset, representing time points before and after the availability of phonological information in the production system. When a spoken word was presented, participants had to indicate whether the word contained a prespecified phoneme. The phoneme monitoring latencies for the spoken words were shorter when the picture name contained the prespecified phoneme compared to when it did not. Moreover, this facilitation of phoneme monitoring was only obtained at the SOA of 600 ms. These results suggest that there are sublexical form connections running from word production to word comprehension.

3.1.9 The visual-auditory color-word Stroop asymmetry

A gold standard of attentional measures is the color-word Stroop task, in which participants name the ink color of written color words (one basic task variant) or read aloud the words and ignore the ink colors (the other basic task variant). Typically, participants are much slower in naming the ink color when color and word are incongruent (e.g., the written word BLUE in red ink) than when they are congruent (RED in red ink). When the task is to read aloud the words and to ignore the ink colors, there is no such congruity effect. The difference in congruity effect between color naming and word reading is called the color-word Stroop asymmetry. According to most existing accounts, the asymmetry is due to a greater discriminability or strength of the words than the colors, as reflected in the shorter latencies for word reading than color naming. In contrast, WEAVER++ holds that the asymmetry arises from the architecture of the word-

production system, whereby words have priority access to pronunciation before meaning, whereas the reverse holds for colors.

Roelofs tested between these accounts in a series of color-word Stroop experiments with auditory rather than visual presentation of the words. Due to the unfolding of the speech signal over time, spoken word recognition is typically a few hundred milliseconds slower than written word recognition. Consequently, the latencies of color naming and spoken word naming are the same. This allows for a test between the strength/discriminability accounts and the architectural account of the asymmetry without having to manipulate the physical size of the word stimuli, such as using an artificially small font in case of written words.

In Experiment 1 participants named color patches while ignoring spoken color words presented with an onset varying from 300 ms before to 300 ms after the onset of the color. In Experiment 2 they named the spoken words and ignored the colors. To guarantee that the colors were seen, subjects were given the secondary task of monitoring for a cross that appeared randomly on some trials. Spoken color words yielded a congruity effect in color naming, but the colored patches did not affect word naming at any stimulus onset asynchrony. Importantly, this asymmetry was obtained with equivalent color and word naming latencies. Written color words yielded a congruity effect in naming the spoken words (Experiment 3), showing that spoken word naming is not immune to interference from visual stimuli. The results favor WEAVER++'s architectural over a discriminability/strength account of the color-word Stroop asymmetry.

3.1.10 Gaze control in word production

In the past it has been assumed that we look at objects just as long as is needed to identify them. However, earlier research in the project suggested that when we want to name an object, gaze duration depends on the time it takes to plan the production of the object's name (Annual Report 1999:23). For example, when speakers are asked to name a visual scene consisting of two objects, they look longer at objects with two- than with one-syllable names even when the object recognition times are the same.

One account, advanced by Zelinski and Murphy (2000), holds that speakers do not shift their gaze before the object name has been planned to prevent Stroop-like interference from the name of the other object. Another account holds that eye fixations reflect the attention required for goal-directed responding (cf. WEAVER++), that is, naming the first object, whereby a gaze shift follows a goal shift.

Roelofs tested between the two views by introducing interference during the naming of an object before the shift of gaze to another object was made. If speakers fixate objects to prevent interference from the names of other objects, introducing distractors during the naming of the object should lead to shorter gaze durations in case of interference compared to no interference. In contrast, if a gaze shift reflects a goal shift, gaze durations should be longer with interference than with no interference, because word planning takes longer with than without interference. The tasks were picture naming, word reading, and word categorizing. These tasks were performed in the context of distractor words or distractor pictures. In all experiments, gaze durations were longer with the Stroop-like interference than without. This suggests that gaze durations in speaking reflect the attention required for goal-directed verbal responding rather than the prevention of interference.

3.2 Multiple word utterances

Multiple access requires the speaker to recurrently perform lexical access. Multiple access not only takes place during the planning of multiple word utterances, but presumably also happens during the planning of complex numerals such as "two-hundred forty-five" (245) and "quarter to three" (2:45).

3.2.1 Producing complex spoken numerals for time and space

Meeuwissen continued her Ph.D. project, supervised by Roelofs and Levelt, on the planning of complex spoken numerals. A new eye-tracking study examined response latencies and gaze durations in planning the production of complex spoken numerals for time and space. Complex numeral pairs were named (Arabic format, Experiment 1) or read aloud (alphabetic format, Experiment 2) as house numbers (space) or as clock times (time). Gaze durations for naming and reading house numbers and clock times were determined by morphophonological variables. In addition, gaze durations and response latencies for naming but not for reading clock times reflected an influence of conceptual variables. However, none of the variables determined the naming and reading latencies for house numbers, indicating a dissociation between response latencies and gaze durations. Moreover, numeral length determined the gaze durations but not the response latencies for clock times. These results suggest that speakers adopt different criteria for articulation onset and shift of gaze for long utterances, both in naming and in oral reading.

A second study contrasted expression format (absolute versus relative) with clock display (analog versus digital). Speakers produced relative time expressions (e.g., "quarter to four") in response to analog and digital clocks. In addition, they produced absolute time expressions (e.g., "three forty-five") in

response to digital clocks. Naming latencies showed evidence of a similar conceptual involvement, along with morphophonological planning, when relative time expressions had to be produced from either analog or digital clocks. In contrast, naming latencies were determined by morphophonological planning factors only when absolute time expressions had to be produced from digital clocks. These findings suggest that different levels of speech planning are involved in clock time production. Furthermore, which particular speech planning levels are engaged is determined by expression format rather than by clock display.

3.2.2 Lexical access in the production of existing and novel compounds

Abdel Rahman, Zwitserlood (U. Münster), and Schiller conducted a study on syntactic processing during compound production to (1) test whether gender congruency of the individual constituents affected the production of existing and novel compounds, and (2) to localize gender congruency effects within the production system. Two pictures of common objects were presented (e.g., a picture of an apple and a picture of a tree) and participants were instructed to produce German gender marked compound phrases with definite determiners (e.g., *der Apfelbaum* 'the apple tree'). The grammatical gender of the constituents was either congruent (e.g., *der Apfel, der Baum*) or incongruent (e.g., *die Nadel, der Baum*). Additionally, definite and indefinite German determiners were presented and superimposed on the pictures. The determiners were either gender-congruent or incongruent with the last constituent which, in German, determines the gender of the compound. Indefinite determiners were introduced to disentangle potential effects of gender congruency at a lexical level and determiner congruency at the word form level because they can be gender congruent but determiner incongruent. In the first experimental session the pictures represented existing compounds whereas they were re-arranged to represent novel compounds in the second session.

For both existing and novel compounds a substantial congruency effect of the constituents was observed. There was also a clear congruency effect of definite determiners, but no interaction between determiner and compound constituent congruency, suggesting that the two factors affect the same processing level. The effect of indefinite determiners did not reach significance. However, excluding stimulus repetitions from the analysis, the presentation of indefinite determiners yielded a reversed congruency effect. That is, the compound phrases were produced slower when the indefinite determiner was congruent than when it was incongruent. A potential account for this finding is that the congruent gender feature receives converging activation from the production and perception stream. As a consequence, the word form of the congruent

indefinite determiner is activated more strongly than the word form of the incongruent determiner, resulting in a competition between the planned definite and indefinite determiners at the word form level. Together, these results suggest that (1) existing compounds — which are assumed to have their own entry in the mental lexicon — are linked to the lexical entries of the constituents and that (2) gender congruency effects can occur at the lexical level and at the level of the word form.

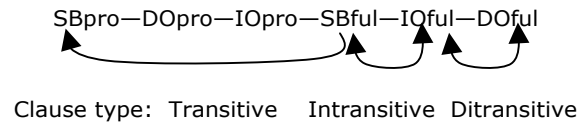
3.2.3 The relationship between grammaticality and corpus frequency of (non-)canonical constituent orderings in subordinate clauses of German

Word order in the midfield of German clauses is typically flexible. Several experimental investigations into the grammaticality (acceptability) of word order variation in the midfield of subordinate clauses of German have recently been published (e.g., Pechmann et al. 1996). The data patterns emerging from these experiments are very similar. While none of the six possible permutations of Subject (SB), Indirect Object (IO) and Direct Object (DO) are definitely ruled out, some are judged considerably more acceptable than others (for a discussion of "graded grammaticality", see Keller 2000).

Theoretical accounts for the obtained data patterns usually employ a ranked or weighted set of Linear Precedence constraints such as "Subject NP<<NPs", "Pronominal NPs<<full NPs", "Indirect Object<<Direct Object" (Müller 1999). The aim of a project by Kempen and Harbusch (U. Koblenz-Landau) was to investigate to what extent informally or formally obtained linguistic grammaticality judgments are mirrored by the frequency of the various orderings in real texts.

From the NEGRA-II corpus, a German treebank containing 20,000 newspaper sentences annotated in full syntactic detail (Skut et al. 1997), all finite clauses were extracted that are introduced by a subordinating conjunction and contain an (SB,IO) and/or (SB,DO) pair, possibly with an additional (IO,DO) pair (with the members of a pair occurring in any order). As for terminology, clauses containing only an (SB,IO) pair are labeled INtransitive; clauses with only an (SB,DO) pair are MONOtransitive; a clause with an (SB,IO) as well as an (IO,DO) pair is DItransitive; both latter types of clauses are called transitive. A distinction was made between pronominal and full (nonpronominal) NPs. An NP is pronominal if and only if it consists of a personal or a reflexive pronoun.

The obtained frequency data can be accounted for by this rather rigid canonical rule:



To each individual constituent, the rule assigns a standard (primary) position before or after its clausemates. Each of the full NPs has a single secondary placement option, which is indicated by the labeled arrows. This freedom in restraint is conditional upon mono-, di-, or intransitivity of the head verb. Mild conceptual factors such as animacy, definiteness, and referential ease enable full constituents to occupy the secondary, more leftward position.

The rule was recently confirmed in an additional study that included all ditransitive clauses in the new TIGER corpus (containing 40,000 sentences; available since mid-2003). The objective was to extract a sufficiently large number of ditransitives to compare the frequencies of argument orderings with the especially fine-grained grammaticality judgments obtained by Keller (2000). His sentence materials include all 24 possible orderings of three NPs, zero or one of them being pronominal. Of these, only eight are actually covered by the canonical rule; the remaining 16 are excluded. It turned out — unexpectedly — (1) that the "canonical" orderings are the ones that had received the highest average grammaticality ratings in Keller's experiment (all of them in fact being judged highly grammatical), and (2) that the extended corpus includes exemplars of all and only the canonical orderings.

How can we explain that the corpus covers only a restricted band of the grammaticality spectrum and does not contain any argument orderings of intermediate or low grammaticality? The limited size of the corpus notwithstanding, it seems unlikely that the absence of noncanonical orderings is caused by data sparseness: in sentence comprehension tasks, noncanonical orderings tend to be harder to process than canonical orderings (Rösler et al. 1989; Bornkessel et al. 2000) — maybe as a consequence of their very low frequency of occurrence (Kempen & Harbusch 2003). A possible (but speculative) explanation is that the canonical rule covers the complete grammaticality spectrum of a subset of German that does not include sentences in an archaic, poetic or otherwise unusual style or register. Before settling on a final answer, the observations need to be checked against a considerably larger text corpus.

4 MULTIMODAL INTERACTION

Introduction

- 4.1 Multimodality
- 4.2 Interaction
- 4.3 Gesture research

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The institute project *Multimodal Interaction* aims to study language and communication within its proper ecological niche, namely natural interaction. As the name of the project indicates, a fundamental assumption is that the use of language in communication constitutes both an *interactive* and a *multimodal* phenomenon. Furthermore, we expect that the properties of multimodal interaction will, at least to a certain degree, be a function of the cultural background of the interactants. Therefore, we are committed to study multimodal interaction from a cultural perspective.

Investigating spontaneous interaction between two or more participants leads to interesting methodological challenges. First, the level of experimental control is lower than is the case in traditional fields of psycholinguistics such as language perception and production. Second, the behavioral data that is recorded is not from a single subject, but from two or more subjects who are acting in coordinated synchrony. This implies that both the stimuli and the responses are generated by the subjects themselves. Needless to say, this leads to less control over the nature of the produced utterances. To address these new challenges, we adopt a multidisciplinary approach, combining methodologies from different fields, including linguistics, psychology, sociology and computational modeling, using both experimental and naturalistic data. We identify our research by the topics that we investigate rather than the methodologies we use.

4.1 Multimodality

The research projects reported under this heading focus on multimodality, i.e., the (typically simultaneous) use of multiple sensory modalities and/or semiotic channels in communication.

4.1.1 A symmetry-dominance construction in co-speech gesture

Hand gestures are known to be tightly linked temporally and pragmatically to spoken utterances. According to current tradition in research on co-speech gesture, there is a division of semiotic labor in speech-with-gesture composites, whereby the 'analytic, linear-segmented, combinatoric' features of speech complement the 'holistic, nonlinear-segmented, noncombinatoric' properties of gesture. McNeill (1992) adds to this that 'if gestures and speech co-occur, they perform the same pragmatic functions'. Enfield investigated this phenomenon in a continuing study of iconic spatially descriptive gestures in informal descriptions of traditional fish-trapping mechanisms by speakers of Lao (Annual Report 2002: 61-62). Results support a reconsideration of the strength of claims that gestures lack linear-segmentation, and serve identical pragmatic functions to their accompanying utterances.

Enfield observed systematic use of a two-phase 'symmetry-dominance' construction in co-speech gesture, in which gestures show linear-segmentation and combinatoric relations, and in which multiple gestures occur simultaneously with different pragmatic relations to the accompanying spoken utterance. The observed pattern consists of 1) a *symmetry phase*, in which the two hands use symmetrical movement to express a single idea (e.g., overall shape of an object) followed directly by 2) a *dominance phase*, in which one hand is held in place, indexing the larger structure from the symmetry phase as backdrop for a new dominant-hand gesture.



Figure 4.1 : Symmetry phase: the speaker describes an upward-facing hole in the base of a fish trap.



Figure 4.2: Dominance phase: the speaker keeps the right hand in place, representing the structure introduced in the symmetry phase, allowing the dominant (here, left) hand to represent new information (here, concerning a 'shelf' on which bait is deposited around the inside of the hole in the trap's base).

In Figure 4.2, while the speaker maintains the discourse referent which was introduced with a symmetrical gesture in Figure 4.1, he cannot maintain the

gesture in Figure 4.1, since he would need a third hand to express the new information. His solution is for the nondominant hand in Figure 4.2 to index the symmetric representation established in Figure 4.1. One conclusion concerns the different affordances of alternative semiotic channels. A given channel has a certain threshold for the amount of information which can be simultaneously expressed. If it is reached, then the information must be segmented and supplied through time in linear fashion. This threshold is much higher for hand gesture than for speech, due to superior affordances of the three-dimensional visual medium for iconic and indexical meaning, doubled by the presence of two articulators. But this threshold is nevertheless still there for hand gesture, as the fish trap study shows. A second conclusion concerns the degree to which hand gestures show structural systematicity. As other recent studies also suggest, researchers appear to have underestimated the degree to which sequences of co-speech gesture are systematically structured, both within and across utterances.

4.1.2 Effects of asymmetric availability of the visual modality in dyadic negotiation.

De Ruiter, funded by the European IST project COMIC, used the SLOT laboratory (Annual Report 2002:48) to study the effect of available modalities on the performance and efficiency of route negotiation. Eight male-female dyads negotiated routes through eight city maps, given the task to minimize both the personal and global costs of the final route. For half of the dyads, a one way mirror was placed between the participants, such that A could see B, but B could not see A. As expected, the frequency of visual communicative behavior such as head movements, facial expressions and posture shifts was much higher in the full modality condition than for the participants at either side of the mirror in the mirror condition. Somewhat surprisingly, the presence of the mirror had no effect on the quality of the negotiated routes. However, it took the dyads in the mirror condition much longer to complete their negotiations. The average negotiation time per negotiated route was 123 seconds for the full-modality condition versus 186 seconds for the mirror condition. Further analysis revealed that this difference was due to longer *silences* in the mirror condition, and not to longer stretches of speech. These results correspond to those from a negotiation study by Drolet & Morris (2000), who also found that negotiations last approximately 25% longer when there is no face to face communication possible. Apparently, blocking the visual modality for just one of the participants has the same effect on the negotiation times as blocking it for both participants. This strongly suggests that for the effectiveness of signals in the visual modality a mutual awareness of mutual visibility is essential.

4.1.3 Multimodal signals for co-production.

Many aspects of interactional coordination rely on anticipation or 'projection' of others' speech and actions. In conjunction with a workshop on this theme (see

Chapter 13), Levinson focused on multimodal signals that are demonstrably used by participants to anticipate upcoming speech or action. Case studies from videotaped interaction in three cultures were examined, using the new ELAN video annotation tool developed by the Technical Group (Chapter 12). Particular cultural practices can be most illuminating. For example, on Rossel Island (Papua New Guinea), jokes are properly received by synchronized yelps timed with hand-shaking. Use of predictable structures (e.g., three-part punch lines) make the precise point for this coordinated display predictable, up to a second before the joke ends. As another example, consider that Guugu Yimithirr speakers in Northern Queensland make use of an 'absolute' gesture system, that is, one where gestures richly annotate utterances with precise directional gestures in the actual orientations of the events narrated. For this reason these, often large, gestures are carefully watched by listeners. Since these large gestures typically precede the affiliated speech by up to 500 ms, they allow anticipation of the utterance that will accompany them: quite often interlocutors therefore produce the utterance to go with the other's gestures, at intervals sometimes as close as 350 ms from the beginning of the would-be speaker's gesture preparation. This is a kind of 'co-production': one participant produces the gestures that go with the other participant's speech.

Co-production is of considerable psycholinguistic interest. The experimental study of utterance production suggests that it takes of the order of 500 ms to go from conception to production (e.g., 600 ms from seeing a picture to naming it). But in interaction participants sometimes finish each others' sentences on the fly, and occasionally even say exactly the same thing at the same time. Again, a cultural peculiarity, this time in Tzeltal (Chiapas, Mexico) offers some interesting insight, since Tzeltal response style requires speakers typically to respond to utterances by repeating part of them (as shown in earlier work by P. Brown). This repetition may then itself be repeated in confirmation by the original speaker. This repetition procedure allows anticipation, so that in a sample dialogue repeated segments often (c. 60% of the time) end up in overlap, and of these overlaps some 15% are choruses (i.e., roughly begin at the same time or end at the same time). Figure 4.3 shows a frame from ELAN software of one such 'chorus', which occurs in the following context:

1. B: *jm, te la spas (kurba)- jich la talem me jochibe*
'yes, it [the underground river] makes a curve – thus it comes out at Jochib'
2. A: *aj jich talem ini*
'Oh, it comes out here?'
[
- 3 B: *jich la talem ini*
'It apparently comes out here'

In the figure, the blue vertical band highlights a moment in the aligned matching responses which finish within 100 ms of each other, although there is a (typical) starting asynchrony. The blue highlighting indicates a moment where both participants are also gesturing the same thing at the same time (see aligned coding of "stro(kes)"). This synchronic matching of speech and gesture is made possible by the cultural practice of acknowledgement by repetition. In future work we hope to get more insight into the psycholinguistic processes underlying co-production in general.

4.2 Interaction

The studies reported in this section focus on the structural properties of multi-party interaction.

4.2.1 Structural preferences in conversation.

Stivers, in collaboration with J. Robinson (Pennsylvania State U.), explored structural preferences in conversation. In conversation analysis, the concept of structural preferences (in contrast with psychological preferences) has yielded rich insight into how conversation is organized. A preference for agreement, for instance, has been shown to be systematic such that agreeing responses are typically delivered quickly, without vocal or nonvocal delay, and without accounts. When someone disagrees their response is typically delayed (e.g., by silence, "Uh", or markers such as "Well"). Additionally, speakers often explain why they are providing a disagreeing response (e.g., "No, I don't have time").

The concept of preference provided insight into how social interaction is organized such that most structural preferences involve social solidarity rather than social conflict among interlocutors.

A recent finding is in line with this tradition. In a corpus of spontaneous, naturally occurring multi-party American English data, two structural preferences were observed: a preference for answers to questions over non-answer responses to questions (e.g., "I don't know"; "I don't remember"); and a preference for the selected next speaker to provide the response to the question. It was observed that these two preferences come into conflict when a selected next speaker does not answer a question immediately upon completion of the question. As a delay emerges, pressure for an answer as well as pressure for that answer to be from the selected speaker must be selected between. Cases where the two preferences come into conflict were collected and analyzed. Results show that there is an overriding preference for sequence progressivity over strict turn allocation. Although nonselected next speakers did not readily provide answers on behalf of selected speakers in most situations, if

a selected next speaker displayed difficulty in answering the question, it was not uncommon for a nonselected recipient to provide an answer to the question.

It was further observed that nonselected recipients rarely used turns in this position for actions other than providing an answer or working to help the prior speaker receive an answer. No instances of nonselected recipients offering "I don't know" or other such responses were observed.

4.2.2 Cross-cultural study of child-caregiver interactions.

P. Brown launched an exploratory subproject, with the aim of studying the socio-communicative environment in which children learn to interact with caregivers and others across different cultures. Research on caregiver-child interaction in Western contexts has been strongly biased toward dyadic mother-child interaction. But the majority of children in most societies grow up in an environment shared with other children and with multiple caregivers in an extended family. This subproject documents the range of caregiver situations represented in a number of different cultural contexts, and the range of variation that exists in how infants are drawn into social interaction in the period prior to producing their first words. The critical age is between about 9 and 15 months, when major social-cognitive abilities emerge, including awareness of others as intentional agents and joint attention with caregivers over a third object or event (Tomasello's 'referential triangle'). Studies of Western infants show that around 12 months of age there is an important developmental milestone: babies look where adults are looking reliably, use adults as social reference points (gaze at them to check what to do in an uncertain situation), act on objects like adults are doing, and actively direct adult attention. All of these are (putatively) essential prerequisites for coordinated interaction, and later for acquiring language. But we have little information about how much this process varies across cultures.

Project members collected video recordings of natural interaction of caregivers with 9 to 15 month-olds in three societies: Rossel Island PNG (P. Brown), Kilivila (Senft), and lowland Laos (Enfield).

4.2.3 Genres in interaction: Kilivila gossip as maximally informal speech event.

Members of the project developed a guide for fieldworkers to collect interaction data and to enable them to produce a sketch ethnography of speaking. On the basis of this guide, data should be collected that represent a *maximally informal speech event* for the respective speech community. This type of speech event should provide the basis for first comparative studies in the project. The most direct way to research this question – following a strictly *emic* approach – is to

check whether the speech community has developed metalinguistic expressions to refer to their various ways of speaking, whether the members of the community differentiate between speech registers and genres by using distinct labels. The concept 'genre' refers to a text or discourse type which is recognized as such by its users because of its characteristic features of style or form and by the functions of texts constituting the genre. One of the most important functions of genres is that they contextualize talk. With this function they help to establish common ground, i.e., they help in interpreting talk, providing information with respect to how texts are to be categorized, and what texts can be produced by whom in what kind of contexts for achieving what means and ends.

Senft compiled the Trobriand Islanders' emic typology of Kilivila ways of speaking. The typology is based on Kilivila metalinguistic terms for the various genres and considers the relationship they have with Kilivila registers that are used in special situations to pursue certain intentions. These registers are also distinguished metalinguistically by the speakers of this Austronesian language. The Kilivila typology of genres reveals that gossip ('*butula*') and gossiping ('*-kayoka-*') constitute the maximally informal speech event for the Trobriand Islanders. Senft collected data on gossiping and processed them for analysis.

4.2.4 DIFF: a comparative communication task.

De Ruiter and Enfield developed the DIFF Task, a dyadic referential communication task that can be used both in the lab and in the field. This enables studies of interaction which are comparable across cultures, keeping the communicative context constant. Two participants each see a picture in front of them, but they can't see the picture belonging to their interlocutor. They are told that the two pictures are similar but in some way different. The task for the participants is to figure out together what the difference is, without looking at each other's picture. The elicited interactions are rich in data on turn-taking, verbal feedback, eye-gaze, and hand gesture. Enfield used the DIFF task to collect data in Lao, (see Figure 4.4) and De Ruiter collected data in Dutch (see Figure 4.5). These data are now being transcribed and coded for comparison.

Inspired by our use of two video recordings in DIFF experiments (a separate camera for each participant) the Technical Group has extended the functionality of the ELAN annotation tool (see Chapter 12.5) to transcribe two synchronized video streams simultaneously.



Figure 4.4: DIFF task session in Doune Ian Village, Laos (language: Lao).



Figure 4.5: DIFF task session at MPI Nijmegen (language: Dutch).

4.3 Gesture research

Gesture has been discontinued as an independent project. Research on gesture and sign language will continue in several Institute projects such as the Multimodal Interaction Project, the Multilingualism Project, and the Space Project. In order to facilitate communication between gesture researchers within the Institute and to maintain visibility to the outside world, the Nijmegen Gesture Center (NGC) has been established, coordinated by Gullberg and Özyürek. The NGC will organize seminars on gesture-related topics and maintain a web site at <http://www.mpi.nl/world/projects/Gesture.html>.

4.3.1 Self-oriented function of gestures

Melinger (Saarland U.) and Kita (Bristol U.) continued their investigation of a theory concerning the self-oriented function of gestures, which claims that gestures facilitate the conceptualization of spatial information for the purpose of speaking. The specific prediction to be tested was that when conceptualization of spatial information is more complex, the speaker spontaneously gestures more to facilitate conceptualization processes. In a study reported in Annual Report 2001:46-47), part of this hypothesis was confirmed. Namely, people produced more gestures when conceptualization was more complex. However, it was not clear whether this effect is limited to the spatial domain. The domain specificity of the effect was tested in the following way. The participants were instructed to describe a path through a network. We momentarily increased the complexity of conceptualization by introducing either an equally difficult spatial or nonspatial secondary task, to be performed during the path description. It was found that speakers produced more gestures when the secondary task was spatial, than when it was nonspatial. It was concluded that speakers produce these gestures to facilitate conceptualization at moments of relatively high conceptual complexity, especially in the spatial domain.

4.3.2 Brain and gesture production

Kita and Lausberg (Free U. Berlin) continued their investigation on hemispheric specialization in the production of co-speech gestures. They examined Lavergne and Kimura's (1987) hypothesis that the linguistically dominant (left, in most speakers) hemisphere is always involved in production of co-speech gestures. In order to test this hypothesis, they investigated co-speech gestures in three patients with complete callosotomy (two with left-hemisphere language, and one with bilaterally represented language) and nine healthy control subjects. It was found that all three patients gestured with both hands. The left-hand gestures by the patients with left-hemisphere language exhibited poorer temporal coordination with speech than the right-hand gestures, which supports our hypothesis that their left handed gestures are generated in the linguistically nondominant hemisphere. In contrast, in the patients with the bilateral language and in the healthy controls both left and right handed gestures were coordinated with speech equally well. It was concluded that the linguistically nondominant hemisphere alone can generate co-speech gestures, just as the linguistically dominant hemisphere can.

4.3.3 Attention to gesture: visual attention and integration of gesture information

Gullberg and Kita continued to investigate the relationship between addressees' visual attention to speakers' gestures and their information uptake from them.

In a previous study (Annual Report 2001:48-49) subjects were shown recordings of gestures embedded in natural story retellings. Their fixations were recorded with an eye-tracker. Information uptake was operationalized as the ability to graphically reproduce information that had only been present in gestures. The study showed that only the gaze of the *speaker* (looking at their own gestures) affected the uptake of gestural information in addressees. There was no simple relationship between addressees' fixations and their uptake. In a follow-up study, these findings were consolidated experimentally by presenting minimal pairs of gesture and speech, in which artificial *holds* and *speaker-fixations* were added. In combination these findings suggest a robust dissociation between addressees' overt visual attention to speakers' gestures on the one hand, and uptake of information from these gestures on the other.

4.3.4 Disfluency – Evidence from speech and gesture.

Seyfeddinipur completed the research for her dissertation on cognitive processes of error detection and speech suspension in selfmonitoring and repair. A corpus of living space descriptions collected from 12 native German speakers was analyzed for disfluent speech and co-speech gestures. The analysis of the speech data indicated that speech is not suspended upon *error detection* but upon *repair readiness*. Furthermore, since the moment of error detection cannot be unambiguously inferred from disfluent speech, a novel approach was taken by using speech-accompanying gestures as an indicator of early error detection. The results showed that gesture is suspended earlier than speech, indicating that speech is not suspended upon error detection. In order to address concerns that the stopping latencies of gesture and speech could have been related to modality differences between the two channels, an experiment was run on the time course of gesture and speech suspension upon an auditory stop signal. No major differences in the stopping latencies between gesture and speech were found. This supports the claim that speech suspension does not always happen immediately after error detection. These findings were discussed in the context of Levelt's perceptual loop theory, and its Main Interruption Rule (Levelt 1983; 1989).

5 SPACE

Introduction

- 5.1 Space in Neurocognition (SpiN)
- 5.2 Space in Sign Language
- 5.3 Shape and classifiers
- 5.4 Parts of the body – preliminaries to a semantic typology
- 5.5 Positionals
- 5.6 Demonstratives
- 5.7 Speech and gesture development in motion event descriptions:
a crosslinguistic study

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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 further developments with respect to the extension of the project into neuroimaging. The next section reports on the use of space in German Sign Language, specifically on how signers express spatial relationships and construct a coherent event space when faced with the task of dynamic event descriptions in narratives. The following four sections continue earlier research reports on the subprojects on shape and classifiers, on body parts, on positionals, and on demonstratives. The final section reports on a crosslinguistic study concerning speech and gesture development in motion event descriptions.

5.1 Space in Neurocognition (SpiN)

The SpiN research group (Janzen, Haun, with Levinson, Levelt, van Turenout, and Hagoort) examined the neural basis of spatial memory and spatial language and their underlying frames of reference.

Janzen and van Turenout continued their work on human spatial memory and present strong evidence that the brain automatically distinguishes between landmarks at navigationally relevant versus irrelevant locations. Studies on the neural basis of navigation have shown the hippocampus to be involved in the creation of an allocentric (or absolute) spatial representation (by O'Keefe and associates), whereas the parahippocampal gyrus has been implicated in the encoding of objects-in-place, and the processing of spatial visual scenes (e.g, in work by Epstein & Kanwisher). In an fMRI study Janzen and van Turenout demonstrated that the representation of objects in the parahippocampal gyrus is directly related to their navigational relevance in a large-scale environment. Twenty right-handed adults (10 female, 10 male) viewed a route through a virtual museum with objects placed at locations relevant (decision points) or irrelevant (nondecision points) for navigation. During subsequent recognition of the objects in isolation, event-related functional magnetic resonance data were acquired (using the facilities of the F.C. Donders Centre for Cognitive Neuroimaging) on a 3 Tesla MRI system (Siemens Trio). Neural activity in the parahippocampal gyrus reflected whether or not an object's location had navigational relevance. Parahippocampal responses were selectively increased for objects that occurred at decision points, independent of attentional demands. This neural marking for navigationally relevant objects was observed for remembered as well as forgotten objects, showing implicit retrieval of navigational information. The automatic storage of relevant object location in the parahippocampal gyrus provides a neural mechanism underlying successful wayfinding and navigation.

In a following fMRI study, the SpiN-project (Janzen, Weststeijn) examined the interaction between the coding of navigationally relevant information (decision points) and the coding of route direction. Fifteen participants (7 female, 8 male) passively viewed a route through a virtual museum (see previous experiment). Afterwards participants were scanned (3 Tesla Siemens Trio) during a spatial masked priming task. They indicated whether they had seen a target-object in the former film sequence. In the paradigm, route direction was operationalised through items consisting of a prime-object that either preceded the target-object (with-route items) or succeeded the target-object (against-route items) on the previously learned route. Prime- and target-objects were either both placed at decision or at nondecision points in the maze. To rule out influences of different navigation-strategies, the prime-object was completely masked through scrambled pictures (sandwich-masking of primes) and therefore was not consciously available. Figure 5.1 shows the timing of a single item.

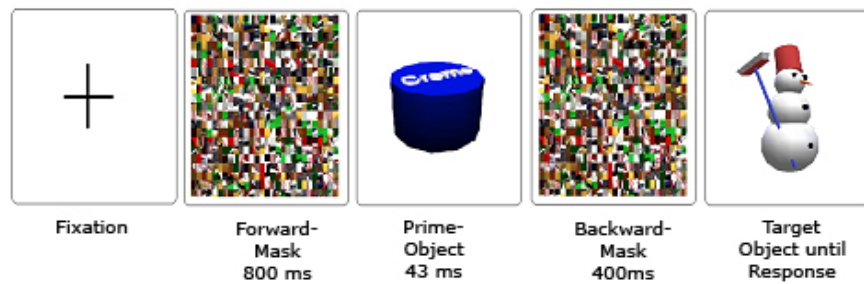


Figure 5.1: Participants were subliminally primed by an object preceding or succeeding the target-object on the route

The target-objects from the virtual museum (requiring a yes-response) were randomly intermixed with new objects where a no-response was required. Blood oxygenation level-dependent (BOLD) contrasts showed an increase in the right parietal lobe for with-route items compared to against-route items only when all objects were placed at decision points in the maze. The right parietal lobe has been shown (by O'Keefe, Burgess and others) to be involved in coding spatial information in an egocentric frame of reference. When computing the same contrast with prime- and target-object placed at nondecision points, no parietal increased activation could be observed. Figure 5.2 shows the increased responses in the right parietal lobe when contrasting with-route and against-route items for decision point objects.

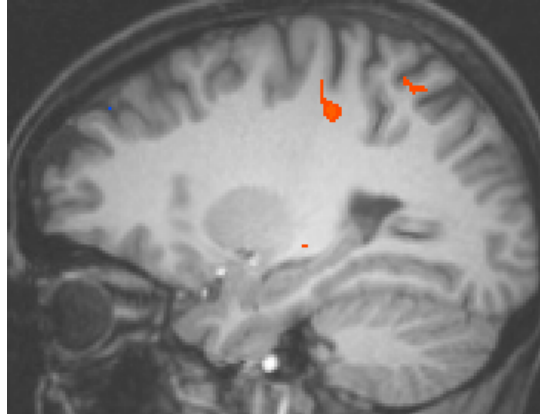


Figure 5.2: Increase in the right parietal lobe for with-route items compared to against-route items when all objects were placed at decision points in the maze (N=15).

The increased activation in the right parietal lobe provides evidence for a coding of route direction in an egocentric frame of reference. This relation between two objects following each other on a route in the sequence in which they were perceived is only represented when both objects appear at navigationally relevant locations (decision points). The coding of decision points in the parahippocampal gyrus (see above study) indicates a representation in an allocentric frame of reference independent from the viewpoint of the traveling person. The coding of relevant locations and the coding of the direction in which knowledge about objects on a route is acquired illustrates the efficiency with which memory systems interact to enable successful navigation.

Further investigating the role of allocentric representations in spatial memory and navigation, Haun initialized a set of virtual reality experiments. Some behavioral models of spatial cognition (e.g., by Spelke and associates) assume that wayfinding is driven solely by local egocentric representations, while global allocentric information only provides back-up strategies when disoriented. Others (e.g., Burgess and associates) suggest that both allocentric and egocentric representations are required. One reason for this unresolved debate is that a given behavioral result might be computationally derived in different ways, leaving some scholars in doubt whether allocentric representations need ever be required to explain behavior.

In order to make distinguishable predictions for global versus local spatial representations, the SpiN project designed fully interactive first person virtual realities (VR, see Figure 5.3) which are locally consistent but feature a global geometrical inconsistency (an impossible or "non-Euclidean" space).

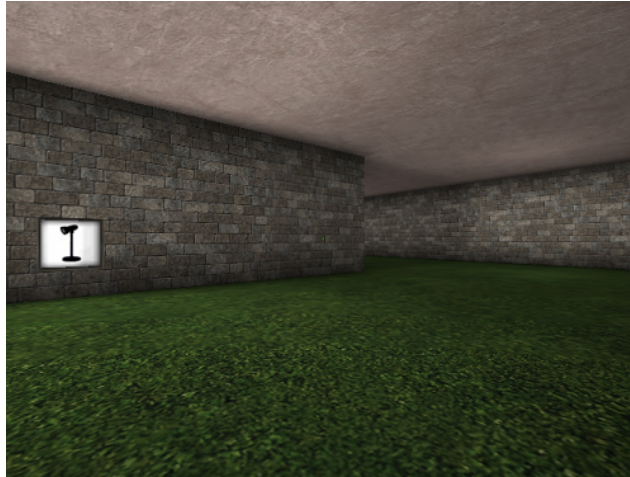


Figure 5.3: Virtual reality from a participant's perspective.

10 participants (6 female, 4 male) were asked to study spatial relations between objects in one "non-Euclidean" and one consistent virtual environment. Later they estimated straight line distances and directions between object-locations from memory. Data collected in the consistent VR were used to establish a performance baseline. Participants' estimates in the inconsistent environment were tested for predictable geometric corrections. If directions are computed via egocentric local path integration, participants' estimates should not show any distortions due to the global inconsistency. In contrast, in an allocentric representation all information has to be integrated into a single, geometrically coherent 'mental map', and therefore should show a globally corrective bias. This latter bias was detected, the most successful predictor of variance being a value that cannot be derived simply using egocentric local information. Participants did integrate information on a global level. The bias in volunteers' estimates is consistent with theories emphasizing the importance of global allocentric spatial representations in human spatial memory and navigation.

5.2 Space in Sign Language

It is a unique property of the visual-gestural modality that virtually all linguistic encoding in signed language is spatial. For this reason, sign languages pose an especially interesting challenge to the study of spatial language and cognition. Research in this area has been continued in the Space project by Perniss within the scope of her dissertation project on German Sign Language (Deutsche Gebärdensprache, DGS).

Perniss has collected a large corpus of DGS data, comprised mainly of (1) spatial descriptions of static scenes, using stimuli created to study frames of reference, and (2) event narratives, using short cartoon clips as stimuli. In the past year, the focus of data analysis has been on the narratives, looking specifically at how signers express spatial relationships and construct a coherent event space when faced with the task of dynamic event descriptions.

It is a hallmark of signed narratives that signers switch repeatedly between different spatial representations (corresponding to character and observer perspective representations, in McNeill's terminology), depending on the type of information to be expressed. In terms of semantic content, this means that signers must make decisions about how to distribute the information they want to express across different representations and different classifier forms. In terms of referent-location associations in space, this means that a single referent will be associated with more than one location in signing space.

The potential problems for interpretation thus introduced by the modality are resolved by another unique property of the modality, namely the availability of simultaneous constructions (following Miller's terminology). It is the use of simultaneity, specifically the simultaneous depiction of two different perspectives, that is one focus of the current research. These constructions, which Perniss has called double-perspective simultaneous constructions, map two distinct perspectives – i.e., representations in character versus observer perspective – onto two different aspects of the signed representation, namely two different articulators (hands, eyes, shoulders, etc). They are remarkable in that they represent not two events occurring at the same time, but rather simultaneously represent the same event from two different perspectives on different articulators. This is markedly different from attested occurrences in co-speech gesture, where two perspectives can be conflated onto a single articulator. Thus there is nothing 'natural' about the distribution across two articulators – rather it appears to be a linguistic constraint in German Sign Language that two perspectives, if occurring simultaneously, must be represented on different articulators.

5.3 Shape and classifiers

Within the classifiers subproject of the Space project, we have turned our attention to the question of how shape information can become a central feature of a grammatical system through classifiers. We are thus looking at phenomena at the intersection of shape as a conceptual domain (with basic distinctions such as dimensionality, axial geometry, and negative spaces) and classifiers as a morphosyntactic category (as a definable set of morphemes which imposes a

classification on nominals or their referents). Given that classifiers often encode basic shape distinctions, our research question is: what grammatical and discourse functions do shape classifiers have?

For instance, Miraña (researched by Seifart) has over 60, mostly shape-denoting, classifiers or class-markers, e.g., *-u* (3D.round), *-hE* (2D.round), *-gwa* (2D.rigid), *-i:7o* (1D.short). These fulfill two basic functions. First, they are employed to derive designations for concrete objects from essence-denoting noun stems, e.g., *úhE-7o* (banana.essence-cl.oblong) 'banana (fruit)'. Second, they are used to mark agreement on pronouns, adjectives, verbs, etc., e.g.,

- (1) *ó-7d ihha-ko tsa-ko múhu:-ko pihhú-ko*
 1S-POS be-CL.pointed one-CL.pointed big-CL.pointed fishing-CL.pointed
 'I have one big fishing rod'

The following example comes from a Director-Matcher task (the Shape Classifier Task, see Figure 5.6 below), where the Director describes a spatial arrangement of wooden props. It illustrates how these class-markers are used systematically for the differentiation of referents, such as *úmé-7e-gwá* (wood-CL.1D.upright-CL.2D.flat) 'wooden plank' versus *úme-í* (wood-CL.1D.medium) 'wooden stick'. Also, class markers are used for the tracking of these referents with pronominal expressions such as numerals, e.g., *ma:kíní-i-va* (three- CL.1D.medium) 'three sticks', demonstratives, e.g., *é:-i-7hE* (DIST-CL.1D.medium-PL) 'those (sticks)', and quantifiers, e.g., *tsi-gwa* (other- CL.2D.flat) 'another (plank)'.

- (2) *píko úmé-7e-gwá-gwu:-kú-dú né:-ne*
 put wood-CL.1D.upright-CL.2D.flat-DIM-DL-comp seem-CL.inanim
 'put what looks like two little wooden planks'
- [...]
- úme-í-gwu:-kú-dú né:-ne ma:kíní-i-va*
 wood-CL.1D.medium-DIM-DL seem-CL.inanim three-CL.1D.medium-PLI
 'looks like two little wooden sticks, three (sticks)'
- [...]
- é:-i-7hE u gwáhEnú-du tsi-gwa*
 DIST-CL.1D.medium-PL 2S.SUB line.up-comp another-CL.2D.flat
 'Like those (sticks) you lined up, (put) another (plank-shaped)'

A comparative study using the same task (the Shape-Classifier Task, see Annual Report 2000, and section 5.6 below) was run in a genetically- and areally-diverse language sample consisting of Miraña (Witotoan; Seifart), Kilivila (Austronesian; Senft), Yukatek (Mayan; Bohnemeyer), Lao (Tai; Enfield), Jahai (Mon-Khmer; Burenhult), Lavukaleve (Papuan; Terrill), and Solomon Island Pijin (Dunn). In addition to confirming the finding that morphosyntactic types of systems for nominal classification do not predict discourse function of classifiers (see Annual

Report 2000), we found the following crosslinguistic variation with respect to the use of shape denoting classifiers in grammaticalized reference-tracking systems: some languages have small and very optional systems, e.g., Jahai (Mon-Khmer). In others, shape classifiers are only used with familiar objects, e.g., in Kilivila (Austronesian). In languages such as Yukatek (Mayan), shape classifiers have some grammatical functions (i.e. unitization), but they are not used for (anaphoric) reference. Only in some classifier languages, is the shape information encoded in classifiers systematically invoked to introduce, differentiate between, and track referents, e.g., in Miraña (Witotoan) and Lao (Tai).

5.4 Parts of the body – preliminaries to a semantic typology

Comparative research on the semantics of terms for parts of the body continued (see Annual Report 2002: 76-86), with emphasis on systematic comparison. One approach pursued was to establish how well the body lexicon from different languages mapped onto a perception-based account of the segmentation of the body. The question was: Do basic terms for parts of the body map on to basic visual segmentation of the body? Addressing this issue involved three steps.

Step 1: establishing the 'basic terms' from the body lexicon

'Basic terms' were defined as being monomorphemic, or polymorphemic but not semantically compositional. Additionally they had to be everyday words and not metaphors. In this way, words like *arm*, *hand*, *finger*, *shin*, and *calf* were included, while expressions like *forearm*, *back of the hand*, and *Adam's apple* were not. Data from 8 languages were collated using these criteria (see Table 5.1)

LANGUAGE	RESEARCHER
Kilivila (Austronesian, Papua New Guinea)	Senft
Jahai (Mon-Khmer, Malaysia)	Burenhult
Kuuk Thaayorre (Pama-Nyungan, Australia)	Gaby
Lao (Southwestern Tai, Laos)	Enfield
Lavukaleve (Papuan, Solomon Islands)	Terrill
Tidore (Papuan, Eastern Indonesia)	van Staden
Tzeltal (Mayan, Mexico)	P. Brown
Yéli Dyne (Isolate, Papua New Guinea)	Levinson

Table 5.1: Languages used in the study.

Step 2: A theory of perceptual segmentation of the body

An account of perceptual segmentation of parts of the body was derived from Marr's theory of visual recognition of objects, whereby if one can visually discern a central axis, then one can project onto this a 3D 'generalized cone'

(or, following Biederman, a 'geon'). If, for a given axis, further sub-axes may be discerned, then a hierarchy of such geons can be derived. Figure 5.4 shows four levels of such a hierarchy of axes and sub-axes in the human body. Note, that the sub-axes are specified for the limbs only and not for the trunk (the exact decomposition of the trunk varies as a function of the body, e.g., a male versus female body will have different sub-components), or the face (there are specialized visual systems dedicated to face recognition – and so parts of the face are the focus of investigation in a separate study).

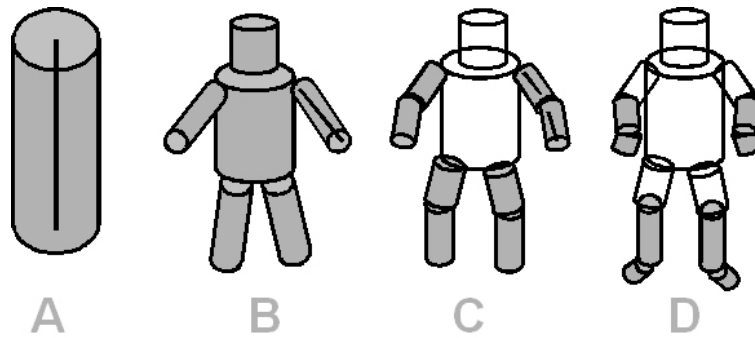


Figure 5.4: Hierarchy of axes in the human body (levels A-D). Each gray cylinder is a new geon. There are 13 geons that could be named from this figure (symmetrical items are only counted once).

Step 3: mapping words onto geons

There was considerable variation between languages in the number of geons that were named. None of the languages named all the geons, but all the languages named at least 5. In addition, there were many basic terms that did not map to geons. The distribution of the basic terms across geons versus joints (where geons meet), and across categories of parts of the body was as follows:

LANGUAGE	GEON	JOINT	FACE	TRUNK	LIMB
Kilivila	13%	8%	32%	39%	8%
Jahai	21%	10%	29%	29%	12%
Kuuk Thaayorre	23%	13%	31%	15%	19%
Lao	24%	21%	29%	26%	0%
Lavukaleve	17%	17%	32%	17%	17%
Tidore	25%	4%	32%	32%	7%
Tzeltal	20%	10%	33%	23%	13%
AVERAGE	20%	12%	31%	26%	11%

Table 5.2: Percentage of the body lexicon for external parts of the body which is used for naming geons, joints, and parts of the face, trunk and limbs.

On average across the eight languages, about 1/5 of the basic terms for visible parts label geons, about 1/3 label the face and its parts, and about 1/2 label parts of geons, or places where geons meet.

Interestingly, we find that not all languages have a term for body, the geon at level A (contra to universals claimed by Wierzbicka, Anderson, etc.). Similarly, not all languages have a term for head: the Jahai term for head does not include the face. Overall, there are more distinctions on the lower than the upper body (contra to Anderson's 1978 universal that languages have more distinctions on the upper than the lower body).

Further work, coordinated by Majid and van Staden, used an experimental approach to investigate whether speakers do indeed respect visual segmentation cues in linguistic categorization of the body. Categorization of limbs was investigated in 7 languages that varied in the number of terms used for the limbs (see Table 5.3). Overall, speakers do indeed respect the visual boundaries present in the human body. However, the most striking finding was that individuals within the same language community could vary considerably in the extension they indicated for a body part term (see Figure 5.5). This has implications for theories of categorization and semantic change.

LANGUAGE (RESEARCHER)	Part of the body					
	UPPER ARM	LOWER ARM	HAND	UPPER LEG	LOWER LEG	FOOT
<i>Jahai</i> (Burenhult)	bling	prbér	cjas	bli'	gor	can
<i>Dutch</i> (van Staden & Majid)	arm		hand	been		voet
<i>Japanese</i> (Kita)	ude		te	ashi		
<i>Indonesia</i> (van der Meij)	tangan			kaki		
<i>Savosavo</i> (Wegener)	kakau			nato		
<i>Solomon Island Pijin</i> (Wegener)	han			leki		
<i>Lavukaleve</i> (Terrill)	tau					fe

Table 5.3: Languages and their associated limb terms.

Figure 5.5: Intralanguage variation in 8 male consultants' indication of the extension of the Jahai term denoting 'lower arm'. The darker the blue color the more consultants agree on the extension of the term.

5.5 Positionals

Bohnenmeyer and P. Brown compared the Basic Locative Construction (BLC) (as used in the unmarked answer to a Where-question) in two Mayan languages, Yukatek and Tzeltal. These languages have very similar resources for describing positions and configurations of objects, including a large set of spatially rich 'dispositional' verb roots. But speakers of the two languages employ different strategies for using dispositional verbs in locative predications. Tzeltal (TZE) speakers use a "multi-verb" strategy, with their locative utterances showing a strong preference for specifying how the figure is spatially dispositioned; Yukatek (YUK) speakers prefer a "single-verb" strategy using a generic existential predicate. Compare for example:

- | | | | | | | | |
|-----|---|-----------|-------|-------------|----------|-----|----------|
| (5) | wax- <u>al</u> | | ta | lum | p'in | | |
| TZE | stand.vertically-DIS(B.3) | | PREP | ground | pot | | |
| | 'The pot is vertically standing on the ground.' | | | | | | |
| | | | | | | | |
| (6) | le | lùuch-o', | ti' | <u>yàan</u> | y-óok'ol | le | mèesa-o' |
| YUK | DET | cup-D2 | there | EXIST(B.3) | A.3-on | DET | table-D2 |
| | 'The cup, it's there on the table.' | | | | | | |

Both options are available in both languages, but the pragmatic conditions for their use are different. What could explain this difference in usage between two such closely related languages? To address this puzzle, the two languages were compared for their linguistic resources and the use of these in answers to

'where' questions elicited with the elicitation tools "Topological Relations Pictures Series" and "Picture Series for Positional Verbs" (cf. Ameka et al., Field Manual 1999).

The comparison provides important insights into the nature of the multi-verb type of Basic Locative Construction (see Annual Report 2000). There appears to be a tendency for multi-verb languages (i.e., languages with contrasting locative verbs) to have a very simple inventory of topological adpositions or case markers – for example, Tzeltal has only one generic adposition. This could suggest a division of labor between the verbal and the adverbial system, such that topological information that is encoded by adverbials in single-verb languages is expressed in the verb in multi-verb languages. The comparison of Tzeltal and Yukatek shows that this conjecture is too simplistic. Yukatek, too, has a generic preposition, very similar to the one of Tzeltal (unlike Tzeltal, there is arguably a second preposition specialized on containment relations.) However, in both languages, ground-denoting phrases in spatial descriptions are optionally augmented with relational nouns encoding meanings such as '(on) top (of)', 'on', 'above', '(at) back (of)', 'behind', etc. If topological information encoded in adverbials in Yukatek were expressed by verbs in Tzeltal, one would expect to find much less use of such relational nouns in Tzeltal than in Yukatek. A quantitative analysis of the ground-denoting adverbials in the Topological Picture Relations Series data showed that this is not the case. This supports the analysis of the semantics of dispositional verbs, which sees the bulk of the meaning of these verbs as figure-related, not ground-related. Ground-related meanings are expressed in spatial adpositions in English or in relational spatial nouns in Tzeltal and Yukatek (although some amount of overlap does occur).

A number of alternative explanations for the divergence of BLC expression in the two languages were considered. One key hypothesis is that the difference may be the consequence of a general typological principle which favors the use of "theme-specific" predicates in clauses with theme arguments. It was suggested that this principle may be operative in Tzeltal, but not (or only to a lesser extent) in Yukatek. In this sense, it may have been inherited from the common ancestor language, but has become "recessive" in Yukatek. This hypothesis is supported by evidence from other domains of verbal predication (e.g., verbs of 'cutting' and 'breaking', and the verbal lexicon).

5.6 Demonstratives

Burenhult's project 'Space in Jahai' investigates spatial language and cognition among the Jahai, a group of hunter-gatherers in the Malay Peninsula speaking a Mon-Khmer language. It thus forms an in-depth case study for the Space

Project as a whole. Several lines of research have been taken up and investigated in the field. The project has contributed data to a number of Space subprojects, including demonstratives, frames of reference, shape and classifiers, the human body as a spatial object, landscape, motion verbs, and space in thinking.

Particular focus has been placed on the rich demonstrative system of Jahai, which has eight distinctions (see Table 5.4). Four apparently distance-related terms were re-analysed as encoding participant-anchored accessibility rather than distance, with attentional contrasts being intimately associated with the two addressee-anchored forms. In particular, the addressee-anchored accessible form *ton* was shown to be used only with referents which were currently attended to by the addressee or which had been introduced previously and were therefore in some way known to the addressee. These conclusions come from examining the use of demonstratives in the Shape Classifier task (see section 5.3 above), originally developed to elicit shape-encoding classifiers (see Figure 5.6).

<i>Functional distinction</i>	<i>Nominal demonstrative</i>
Speaker-anchored accessible	tãh
Addressee-anchored accessible	ton
Speaker-anchored inaccessible	tani?
Addressee-anchored inaccessible	tũn
Speaker-anchored exterior	tadeh
Addressee-anchored exterior	tɲi?
Superjacent	titih
Subjacent	tujih

Table 5.4: Demonstrative distinctions in Jahai.



Figure 5.6: Two Jahai consultants playing the 'Shape Classifier Task'.

The Jahai demonstrative system also includes crosslinguistically unusual distinctions encoding 'elevation' (2 forms: superjacent and subjacent) and 'exteriority' (2 forms: speaker-anchored and addressee-anchored) of the referent in relation to the speech situation. In the exterior distinctions, the speaker-anchored form is used with referents located on the other side of the speaker from the addressee, whereas the addressee-anchored form is used with referents located on the other side of the addressee from the speaker. Specific elicitation tasks were developed to investigate the detailed spatial characteristics of these forms: seven Jahai consultants were asked to judge the extent of spatial sectors beyond each participant in which 'exterior reference' was acceptable. The 'beyond' character of referents was confirmed, and it was shown that the ideal location of the referent was one in which it was exactly aligned with speaker and addressee, and in addition that the direction that each participant was facing in was irrelevant. Furthermore, it was shown that these crosslinguistically unusual distinctions, unlike the more universal 'distance'-related ones (which often involve other contrasts), can be straightforwardly analysed in purely spatial terms (see Figure 5.7).

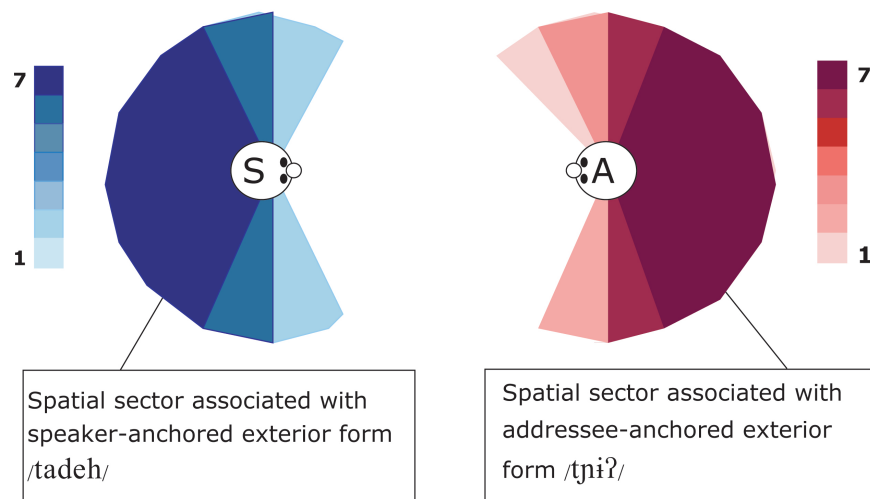


Figure 5.7: Seven Jahai consultants' judgments of the extent of the spatial sector beyond each participant (S = Speaker, A = Addressee) in which exterior demonstrative reference is acceptable. The darker the sector, the more consultants agree on acceptability. (In the particular trial illustrated here speaker and addressee face each other, but in other trials they were faced in differing directions, with similar results.)

Özyürek, together with Küntay, (Koç U.) investigated the development of Turkish children's use of demonstratives during conversational interactions. Turkish makes a three-way distinction in its demonstrative system (*bu*, *şu* and *o*) which systematically and obligatorily encodes spatial contrasts (*bu* versus *o*) as well as presence or lack of addressee's attention (*şu* versus *bu* and *o*) on the referent. Therefore, in learning how to use demonstratives Turkish children have to learn not only to encode the spatial contrasts about the relative location of objects with respect to the interactants, but also the attentional contrasts, that is, to track where the attentional focus of their interactant is in relation to the object referred to. Previous research on the development of demonstrative pronouns in English has suggested that children use demonstratives first for attention-getting functions and learn the spatial contrasts later. Furthermore, the literature on the development of joint attention skills also shows that children learn to achieve joint attention on objects early on, suggesting that Turkish children would learn to encode the attentional contrasts in their demonstratives early. However, data collected from task-related interactions of 4-year-olds (N=6), 6-year-olds (N=6) and adults (N=6) showed that even at the age of 6, children still do not mark the attentional contrasts (that is, they use *şu* when the addressee's attention is not on the referent) while in fact the

spatial contrasts are learned early (i.e., using *bu* for objects close to the speaker and *o* for objects far away). This data suggests that in languages where the use of the demonstrative forms require children to coordinate their attention with that of their interlocutor on the object referred to, the correct use of these forms develops later in childhood. Thus using referential forms while taking into account the recipient's attentional state is a pragmatic feat that apparently takes more than six years to develop.

Senft edited and submitted an anthology on 'Deixis and Demonstratives in Oceanic languages' to Pacific Linguistics, Canberra. The contributions to this book (by Ross, Margetts, Senft, Næss, Bril, Ozanne-Rivierre, Mosel) focus on spatial deixis, especially on demonstratives and their spatial deictic use in Takia, Saliba, Kilivila, Pileni, Nêlêmwa, Iai, and Samoa. The final chapter (by Ross) discusses demonstratives, local nouns and directionals in Oceanic languages from a diachronic perspective. This selection of papers illustrates how spatial deictic systems vary broadly in this language family with respect to their morphosyntax, their semantics and their use. We find systems that dedicate more of their morphosyntactic resources on discourse deixis than on spatial deixis (Takia), systems that differentiate speaker-based versus addressee-based proximal forms from one distal form (Saliba, Iai), those that distinguish a speaker-based versus an addressee-based proximal form and a distal or 'third person' form which refers either to objects away from both speaker and addressee or to objects close to a third person (Pileni), and those that constitute a speaker-centered three-term system with respect to distances distinguished (Kilivila, Nêlêmwa). We also find those that differentiate between objects or persons referred to that are together with the speaker, within the reach of the speaker, together with the addressee, within the reach of the addressee, not far away but not in reach of speaker and addressee, and far away both from speaker and addressee (Samoan). The variety observed in these systems within one language family confirms former findings in the Space project about the typological varieties of demonstrative systems (see Annual Report 1998 and 1999), and how subject they are to diachronic change.

5.7 Speech and gesture development in motion event descriptions: a crosslinguistic study

In an National Science Foundation (NSF) funded project, Özyürek in collaboration with Kita (U. Bristol), Allen (Boston U.), P. Brown, Turanli (Bogazici U.), Ishizuka (Boston U.) has been investigating differences in the patterns of online spatial thinking through the observation of gestures in motion-event descriptions across three different languages (English, Turkish and Japanese),

both with adult and child speakers. Previous work has shown that adult speakers of these languages use different syntactic constructions (with respect to 'manner' and 'path' packaging) when describing motion events, and their iconic gestures parallel these linguistic differences. The main question of the new project focuses on children, and asks whether these kinds of linguistic and gestural patterns show variation early on or rather reveal universal patterns. Comparison of adults (N=20 in each language) with 3-year old children (N=20 in each language and mean age =3;3 to 4;3) shows that *verbal* depictions of events reveal both universal as well as language-specific patterns. English speaking as well as Turkish and Japanese children use the language-specific adult language patterns at age 3. However while English children use the adult patterns (*The tomato man rolled down the hill*) as frequently as their adults, Turkish and Japanese children seem to use the language-specific construction (e.g., the adult Turkish form *Yuvarlanarak asagi iniyor*, 'he went down rolling') much less than their adults. Turkish and Japanese children also use constructions resembling the English pattern even though such constructions are never used in the adult patterns in their own language (Turkish: manner verb+ spatial noun, e.g., *domates adam asagi yuvarlaniyor*; Japanese: mimetics+path verb, e.g., *guruguru-tto ue-ni agat-te*) suggesting that expressing both manner and path using subordinate constructions might be harder for children universally.

Furthermore, the comparison of the *gesture* results showed that while English adults used predominantly conflated gestures (manner and path expressed in one gesture), Turkish adults express manner and path elements as separate gestures. However Turkish and English childrens' gesture-patterns looked very similar to each other and did not show any language-specific patterns, suggesting universal tendencies in gesture development. These results suggest that the integration of representations in speech and gesture might take years of practice with the specific linguistic pattern.

6 PIONEERS OF ISLAND MELANESIA

Introduction

- 6.1 Deep-time areal linguistic comparison
- 6.2 Linguistic and cultural contact
- 6.3 Linguistic description

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The Pioneers of Island Melanesia Project is an international, interdisciplinary project funded under the European Science Foundation program Origin of Man, Language and Languages, within their EUROCORES scheme. The project involves four teams: linguists, biological anthropologists, archaeologists and population geneticists. The linguistic part of the project is based at the Institute, and is the subject of this report.

The overall aim of the project is to investigate the deep prehistory of Island Melanesia, from the time of first human settlement some 40,000 years ago, up to and including the arrival of speakers of Austronesian languages some 4000 years ago. Island Melanesia comprises the islands off the east coast of Papua New Guinea, including the Bismarck archipelago, the Louisiade archipelago, Bougainville and the Solomon Islands. The earliest human settlers colonized the area during the last ice age when sea levels were up to 80 meters lower than at the present, and the land masses were correspondingly larger, and sea crossings therefore smaller. A period of tens of millennia followed, during which these people dispersed throughout the islands, populations became entrenched, languages presumably diversified, and the land mass shrank, before the arrival of the Austronesians. During the last 4000 years there has been constant interaction between Papuan and Austronesian groups, leading to the language map we see today, with some hundreds of Austronesian languages, all from the Oceanic branch of the Austronesian family, distributed over the islands, interspersed with a couple of dozen Papuan languages, the internal relationships of which are as yet unknown.

The project has three main areas of interest: investigating areal and genetic relationships between the Papuan languages of Island Melanesia; investigating contact-induced language change between Papuan and Austronesian languages; and linguistic description of previously unstudied languages in this area.

In the previous year a major focus of our work was investigating Austronesian-Papuan contact. During the last year we have also moved into investigating the bigger picture: deep prehistory and the areal and genetic relationships between the Papuan languages of Island Melanesia. We also continue our work on description of individual languages. The rest of this report is divided into three sections. The first section reports on our work on deep-time areal linguistic comparison; the second section reports on investigating cultural diffusion between Papuan and Austronesian groups; and the third section reports on ongoing work in linguistic description.

6.1 Deep-time areal linguistic comparison

The aim of this subproject is to identify similarities between widely divergent languages, beyond the time range of traditional historical linguistic methods. At issue is the as-yet unresolved question of the nature of the relationships between the Papuan languages of Island Melanesia. That is, we are investigating whether it is possible to show that the Papuan languages form a single genetic family, or more than one family. A separate question is whether the Papuan languages of Island Melanesia form a Sprachbund (linguistic area). Genetic relationships between the languages have almost certainly been obscured by the great time depth; traditional methods of historical linguists go back only around 8000 years at the most, which in this area is just when the Austronesians arrived.

To address these issues the project has applied new methods of dealing with this great time depth: geographical mapping of linguistic relatedness, and cladistic analysis of linguistic similarity. The first enterprise aims to track individual linguistic features, and see to what extent they cluster together in significant ways. The second enterprise takes languages, rather than linguistic features, as the unit of comparison, and aims to see to what extent, and in what respects, they show similarities. These enterprises are complementary; they are two ways of looking at the same data, but the different perspectives from each question should give us interesting points of comparison.

In order to carry out both of these enterprises, Robinson, assisted by the Technical Group (TG) and Dunn, developed a multiple-user database of linguistic features to serve as the data source. The database is based on a grammatical questionnaire written by Terrill with the help of project members. The questionnaire comprises about 250 questions, some of which are of a general typological nature, and others target specific known differences between Papuan and Austronesian languages. Data comes from three sources: either from project members working with their field languages, or from researchers outside the project but affiliated with the project, who provide data from their field languages; or from various published and unpublished materials where these are available.

The database enables generation of specific hypotheses of language relationship, which can then be directly tested. For instance the database allows us to make definite statements on exactly how similar our languages are, thus avoiding the problems of unmotivated claims which often plague large-scale or deep-time linguistic comparison.

An important part of our work is to make sure the linguistic data we generate is

commensurate with the data emerging from our other member disciplines. The database fulfills these criteria, and it is envisaged that ultimately all the data from each member discipline will be pooled to form a composite picture of the languages and peoples of Island Melanesia.

6.1.1 Geographical mapping of relatedness

Our general hypothesis is that linguistic similarities will reflect geographical dispersal. Dunn, together with project members, has operationalized this hypothesis as follows. Our linguistic features database is incorporated into a mapping program so that linguistic similarities are directly mapped in a way that reveals any geographical patterns.

At this initial stage in our research we are limiting our field of inquiry to the issue of both the internal relationships between Papuan languages of Island Melanesia, and the relationships of the Island Melanesia Papuan languages to the Island Melanesia Oceanic languages. Ultimately we hope to be able to investigate the relationships of Island Melanesia Papuan languages to mainland Papuan languages.

The mapping software produces a schematized map of Island Melanesia; each language is represented by a box which appears in the approximately correct relative locations. Austronesian languages also are included in our database, in order to give a point of comparison to the Papuan languages.

At this stage the primary use of the maps is twofold: to test existing hypotheses about the relatedness of the languages, and to generate hypotheses based on clusterings of linguistic features revealed by the process, which would have otherwise been unsuspected.

6.1.2 Cladistic analysis of grammatical similarity

Dunn, with the help of project members, has used cladistic analysis, a method for modeling relationships between large, multivariate datasets. Briefly, the distance between datasets is expressed visually as length of lines on tree diagrams. Cladistic techniques are most commonly used in phylogenetic analysis of biological entities. However, in linguistics some important assumptions of phylogenetics do not hold, especially with respect to two things

1. Common ancestry — it is highly controversial to assume that all languages share common ancestry (the Proto-World hypothesis). It is widely assumed that no proof of universal shared linguistic roots will ever be possible. Within the Pioneers of Island Melanesia Project, we take this to mean that we cannot assume, in the absence of linguistic evidence, that an arbitrary given pair of languages shares a common ancestor.

2. Nongenetic influence is nonheritable – this is clearly not the case for languages, as linguistic contact has a major role in language change. Within the Pioneers of Island Melanesia Project we have abundant evidence of contact-induced linguistic change between Austronesian and non-Austronesian languages. This is highly important for the interpretation of results. It is always possible to produce a tree with a single ancestor node, but it is not the case that this tree can be assumed to represent a set of real, historical branchings from a real ancestor. Despite this, the branchings of a cladistic tree are meaningful, as they allow linguistic similarity to be compared on a high level.

Cladistic trees were produced using a majority rules consensus method 1000 trees produced by bootstrap resampling. The language sample contains typological data on 24 languages (Oceanic and Papuan), with a mixture of ordered and unordered characters. Taking the Oceanic languages as an outgroup gives the tree shown in Figure 6.1.

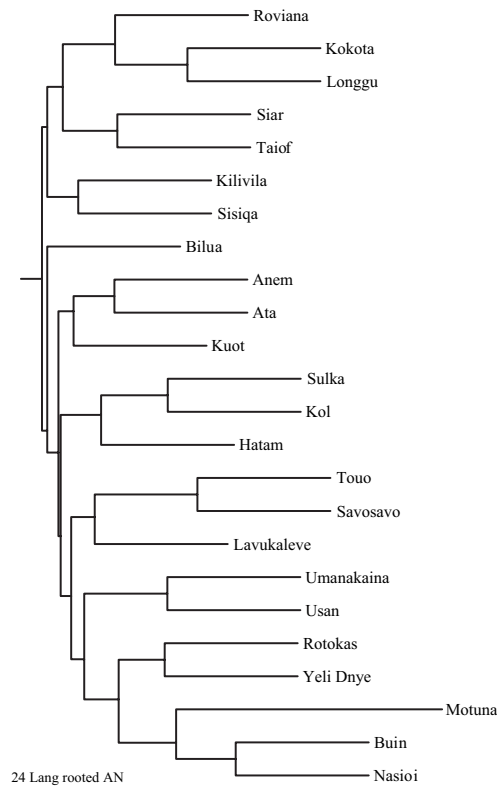


Figure 6.1: Linguistic tree rooted at Austronesian languages.

There is evidence for a number of clusterings within the Papuan languages: higher level clusterings have weak statistical support, but the low level clusterings such as Anêm-Ata, Kol-Sulka, Touo-Savosavo, and the South Bougainville languages Buin-Nasioi-Motuna are firmer. Some of these reflect relationships already illuminated through other methods, but several are new, and will be used to drive low-level investigations of particular pairings. The effect of Oceanic contact on the Papuan languages is also apparent in the cladistic trees: greater degrees of similarity are reflected in closer branchings, with Bilua showing the greatest degree of influence and South Bougainville the least.

6.2 Linguistic and cultural contact

6.2.1 Beyond language: Kinship and cultural diffusion and reconstruction

In order to gain an understanding of life in pre-Austronesian Island Melanesia, as well as the nature and extent of cultural contacts following Austronesian arrival, it is important also to look at cultural patterns of various kinds. Looking superficially at the present situation, there is a dominance of traits that are generally understood to be Austronesian, not the least of which is the fact of near-universal matrilineal kinship reckoning in this region. Much like grammatical traits, cultural traits appear in bundles. For instance, matrilineal kinship typically goes with settling with the bride's kin group after marriage, as does access to resources through matrilineal kin. When we find post-marital settlement among the groom's kin, as with Kuot speakers in New Ireland, or rights to important resources like garden land transferred in the male line, as with speakers of Yélî Dnye on Rossel Island, it is a reasonable working hypothesis that such disharmonic traits are due to a pre-Austronesian cultural substrate. It is fortunate for our purposes that matrilineality is somewhat marked in a global perspective, and that the norm in New Guinea Island societies is patrilineality.

Lindström constructed a questionnaire targeting traits that deviate from the matrilineal 'norm', based on cultural data pertinent to Island Melanesia specifically, as well as on material describing typical clusterings of cultural traits globally, especially Burton et al. (1996). The latter correlates features of social organisation, including details of kin terminology structure, settlement structure and many others. Burton et al. assign numerical values to the various features according to the tightness of clustering in their global data, providing a useful measure of typicality of co-occurrence. Lindström's questionnaire is constructed so as to be compatible with other project questionnaires. Data is to be collected primarily for the linguists' field languages and languages neighbouring these,

together with the list of proto-Oceanic reconstructed vocabulary compiled by Terrill, so that information on mutual borrowings will be available both for lexical and cultural traits for sets of languages with shared contact histories.

6.3 Linguistic description

6.3.1 Savosavo

Wegener, a Ph.D. student, continued her work on a grammatical description of Savosavo, one of the Papuan languages of the Solomon Islands.

Based on data collected in five months of fieldwork, the patterns of object marking on verbs were investigated in more detail. In Savosavo, object marking is obligatory. There is a small class of verbs that mark the object internally, by stem modifications. Four verbs of this kind have been found so far. On all other object-marking verbs, objects are marked by means of prefixes, suffixes or both (cf. Annual Report 2002:102), i.e., some verbs always take a prefix, some a suffix and a very few take both. 'Give' is a special case in that it marks both the recipient and the gift with a suffix and a prefix respectively.

The way in which a verb marks its object does not depend on phonological properties of the verb stem (although all verb stems that take a prefix start with a vowel; there are, however, verb stems starting with a vowel in the suffixing class as well), nor is there any hint of a semantic motivation for the different conjugation classes (e.g., based on semantic domains or different levels of semantic transitivity).

Another interesting feature of Savosavo is its noun class system. It consists of two classes. Third person singular pronouns and object marking affixes show agreement, as well as some nominal dependents, a postposition and some particles.

Nouns referring to humans and higher animate beings are assigned to one of the classes according to their natural sex. All other nouns are by default assigned to 'masculine' class. However, there are contexts in which these nouns can be assigned to the 'feminine' class, e.g., to highlight the small size of something, or to downplay one's own contribution ("this is my little story") or the importance of an object ("just a fishing bamboo").

6.3.2 Rotokas

Robinson, a Ph.D. student, started a descriptive fieldwork-based project on Rotokas, a language spoken in the north of Bougainville. Robinson's work has so far focused on the phonology of Rotokas, which is known to possess one of the smallest phoneme inventories in the world, with only 5 vowels and 6 consonants

(Firchow & Firchow 1969; Maddieson 1984). The consonantal phonemes are *p*, *d*, *g*, *v*, *t* and *k*, and there are five vowel positions, *i*, *e*, *a*, *u*, and *o*, with contrastive length. Although the segmental phonology is reasonably well described, virtually no information is available concerning the suprasegmental phonology of Rotokas, and this has been Robinson's principle area of inquiry.

Earlier work (Firchow 1974) has shown that stress normally falls on the first syllable of a word, but there are exceptions relating to vowel length. For example, among bisyllabic words alone, there are two patterns of stress, summarized in Table 6.1.

STRESS PATTERN	WORD
1 st syllable	<i>kepa</i> 'house'
	<i>keetaa</i> 'chin'
	<i>voosi</i> 'blind'
2 nd syllable	<i>torii</i> 'bamboo'

Table 6.1: Rotokas: Stress in Bisyllabic Words

The basic pattern for disyllabic words is that stress falls on the second syllable if and only if the second syllable of a word is long, but the preceding syllable is short. This can be formalized within the framework of Metrical Stress Theory (Hayes 1994; Kager 1994). The observed stress assignment is predictable, given the following assumptions:

- (1) Feet are trochaic: a foot may consist of a heavy (H), or a heavy-light or a light-light sequence of syllables (HL or LL). The first syllable of a foot is prominent.
- (2) Words are divided into feet proceeding from left to right. Degenerate feet are permitted (i.e., a single L syllable).
- (3) Word stress falls on the leftmost full (nondegenerate) foot.

Further work on Rotokas suprasegmental phonology will attempt to strengthen this analysis and provide more phonetic detail concerning the correlates of stress.

6.3.3 New Britain

Based upon fieldwork carried out in December 2002 and an unpublished grammar (Schneider 1942) Reesink has found a number of typical Oceanic features in the Papuan language Sulka: the marking of realis and irrealis in pronominal proclitics to the verb, presence of pronominal articles, attributive adjectives with a nominalized form and requiring their own article, and some deictic elements clearly cognate with forms in Oceanic Tolai.

On the other hand, Sulka's possessive constructions and its plural noun formation with its many declensions, suggest an older Papuan strain. Some further study may yield evidence of early contact with Oceanic languages of southern New Ireland, while a more recent layer of evidence (lexical items and social organization, as expressed in names of the clans belonging to the matrilineally defined moieties) points to contact with Sulka's present neighbour, Oceanic Mengen.

The preliminary conclusion is that Sulka as it is presently spoken has been shaped by people who spoke some kind of Papuan language (possibly related to some other Papuan languages of Island Melanesia) who came into contact with Oceanic speech communities (e.g., perhaps through intermarriage or trade) at different times, taking on various morphosyntactic constructions that are typical of the Oceanic languages in general (Lynch, Ross & Crowley 2002).

Kol is another Papuan family-level isolate, spoken in East New Britain. A grammar sketch by Reesink is in progress. Like Sulka and other Papuan languages of New Britain it has SVO order and prepositions. Like Sulka, Kol has many noun declensions based on the plural formation of the nouns. In addition this language has nine noun classes. The verbal system of Kol is far more complicated than that of Sulka, involving a great number of conjugations (possibly more than 12) on the basis of person-number marking of A and actor-S. A number of conjugations (verbs with C-initial stems) mark these categories in two positions on the verb, sometimes resulting in suppletive stems.

6.3.4 Dyadic kin terms in Yélî Dnye and Lavukaleve

Evans has recently drawn attention to the widespread existence of 'kinship dyads' in Australian languages of different families. These are terms, often derived systematically from basic kinship terms, that mean e.g., "an uncle and his nephew". It seems that Papuan languages may be another group of languages that often exhibit this feature. In the Island Melanesia Papuan languages under investigation both Yélî Dnye (Rossel Island, Papua New Guinea) and Lavukaleve (Russell Islands, Solomons) have kinship dyads. Both languages will be discussed briefly in turn. The Yélî Dnye facts (collected in the field by Levinson) are as follows. The kinship system is overtly matrilineal (covertly dual decent), with a Crow Type III terminology overlaid with a rule of equivalence of alternating generations. The table below shows the dyadic terms together with their source non-dyadic term (M, F, S, D, B, Z, H, W are abbreviations for Mother, Father, Son, Daughter, Brother, Sister, Husband, Wife, respectively – the full classificatory range of kin terms is not detailed here):

NON-DYADIC SOURCE TERM	Meaning	DYADIC TERM	Meaning
(<i>tp:ee</i>)	'woman's child'	<i>ghee</i>	'woman with her S, D, ZS, ZD'
(<i>tp:ee</i>)	'man's child'	<i>mupwo</i>	'man with S' or 'woman with BS or DS'
<i>mbwó</i>	'man's B, woman's Z'	<i>mbwémi</i>	'man with his B', 'woman with her Z'
<i>chêê</i>	'man's ZS, ZD'	<i>chimi</i>	'man with ZS, ZD'
<i>kee</i>	'man's BS, BD and grand-children (non clan-members)' 'woman's clan descendants'	<i>keemi</i>	'man with his BS, SS, DD...' 'woman with DDS etc.'
(<i>mg:êê</i>)/ <i>dyémi</i>	'man's WB'	<i>dy:eemi</i>	'man with his WB'
<i>mbwiyé</i>	'man's WF, WM, DH or WFM'	<i>mbyw:eemi</i>	'man with WF, WM, DH'
' <i>n:ââ</i>	'man or woman's SW, BSW, etc.'	' <i>n:eemi</i>	'man or woman with SW etc.'
<i>vyíló</i>	'woman's HZ or HBW'	<i>vyimi</i>	'woman with HBW or HZ'

Table 6.2: Dyadic kin terms in Yélî Dnye (uncertain terms given in brackets).

A further feature of the system is that, when inflected with the augmentative plural *knî*, as in '*u kpâmu ghee knî*' 'his wife with child PLURAL', the propositus ('his wife') is not pluralized, but rather the junior members of the dyad – thus although the relation is lexicalized, the plural takes scope only over the non-propositus member of the dyad.

Lavukaleve too has dyadic kin terms. The Lavukaleve data was collected in the field by Terrill. Like Yélî Dnye, Lavukaleve has a matrilineal kinship system. Table 6.3 shows the Lavukaleve dyadic kin terms. They are all based on two kin terms: *kakal* 'older sibling' and *kane/kaone* 'family grouping' (*kaone* is an older term being superseded by the newer stylistic variant *kane*).

Table 6.3: Dyadic kin terms in Lavukaleve

<i>kakalemal</i> (du.m)	a pair of brothers
<i>kakaleol</i> (du.f)	a pair of sisters
<i>kakalel</i> (du.m)	a pair of siblings ¹
<i>kakalev</i> (pl)	a group of more than two siblings
<i>ka(o)nel</i> (du. m)	a pair of relatives, at least one of whom is male ²
<i>ka(o)neol</i> (du. f)	a pair of female relatives ³
<i>ka(o)nege</i> (pl)	a group of more than two relatives, at least one of whom is male ⁴
<i>ka(o)nefa</i> (pl)	a group of more than two female relatives ⁵

¹ most likely brother and sister

² typically a parent and child, uncle/nephew or niece, or aunt/nephew, etc.

³ typically mother and daughter or two sisters, aunt and niece, etc.

⁴ typically a parent and two or more children, a group of sons, etc.

⁵ typically a mother and two or more daughters, a group of daughters, aunt and nieces, etc.

Under Lavukaleve gender assignment rules, a noun referring to multiple referents is feminine if all the referents are feminine, but if there is a group of both feminine and masculine referents, the group takes masculine agreement.

For the sibling terms, however, the gender system is slightly different than elsewhere in Lavukaleve grammar. There are special terms, as one would expect, for all-female combinations and mixed-gender combinations, but, unusually, there is also a special term for an all-male pair of siblings: *kakalemal*. Note that all the gender/number combinations are derived from existing morphology in the language; *-mal* is a very common masculine dual suffix, *-eol* is very common as a feminine dual suffix, *-l* is common as a dual suffix without specific gender connotations, and the *-ev* of *kakalev* 'a group of more than two siblings' is a common plural suffix. One cannot say that these are regular suffixes, because there is so little regularity in dual and plural marking in the language (Terrill 2003) but all of these forms occur frequently with these morphological meanings.

The sibling and family-group terms do not specify the exact composition of membership, but there are strong pragmatic associations with each term. For the sibling terms, the term which does not have gender overtly marked, *kakalel*, strongly implies, by virtue of the fact that neither an all-female, nor an all-male

term was used, that the sibling pair must be of mixed gender. Note that the non-dyadic term *kakalea/kakal* 'older sister, older brother' can only be used to refer to older siblings, but obviously nonsingular forms of the stem in these dyadic uses must have include a younger member as well as an older member. The dyadic terms based on this stem thus etymologically mean 'a pair including an older sibling', thus, by implication, an older sibling and a younger sibling.

With the family-group terms, although exact membership is not specified, these terms refer to mixed-generation groups. Typically, the referents will include one from a higher generation and one from a lower, in the case of dual terms, or one from a higher generation and more than one from a lower generation. Thus, typical groups referred to by these terms are a parent and their children, or an aunt or uncle and their niece/nephews. Interestingly, *ka(o)nege* and *ka(o)nefa* can refer also to a group of sons or daughters respectively. In this case, the grouping is taken from the perspective of a parent, although the term does not actually encode reference to a parent. That is, for example, the same group of men could be referred to as *kakalev* 'a group of more than two siblings' or *kanege* 'a group of more than two relatives'. The former views the group from the perspective of their relationship as brothers. The latter views the group from the perspective of their relationship as sons of the same mother.

Whether dyadic kin terms exist in other Papuan languages of Island Melanesian awaits further investigation.

7 EVENT REPRESENTATION

Introduction

7.1 Argument structure

7.2 Event parsing and event categorization

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Joint research with other projects:

Space

The Dynamics of Multilingual Processing

To be able to talk about their experiences, speakers have to parse the ongoing perceptual flow into units and categorize these units as instances of recurrent event types such as "running" or "breaking something". They must also decide which participants an event has, how to mark the elements denoting these participants, and how to map them onto syntactic clause structure. Speakers of different languages do this in different ways. The goals of the Event Representation Project are to explore the range of crosslinguistic variation in event encoding, and constraints on it, to discover how children learn language-specific patterns of event encoding, and to investigate the relationship between linguistic and nonlinguistic event representations.

A hallmark of the project from its inception has been the development and use of structured elicitation tools to allow close comparisons of event descriptions collected across a wide range of field languages. An important development in 2003 was the increased attention to identifying promising statistical techniques and adapting them to the task of revealing the structure in the group's large crosslinguistic data sets (see 7.2.2.1 for an example). In May the group held a workshop, led by Boster (U. Connecticut, Storrs), on ways of collecting and analyzing similarity data. Major group effort went into the "Cut and Break" project, which examines how events of separation and material destruction are encoded in a range of genetically and areally diverse languages, and how children acquire the meanings of the verbs in this complex semantic domain. This work marks the project's first systematic effort to study both adult languages and child language acquisition using similar elicitation tools.

Research in 2003 also addressed problems of argument structure, participant marking, and predicate semantics in individual languages or language pairs. Conceptual domains receiving special attention include motion and placement events (joint research with Space and Dynamics of Multilingual Processing), causality, possession, and reciprocity. Structural domains of particular interest include complex verbs and the linguistic encoding of three-participant events. The relationship between linguistic and nonlinguistic representations was studied in Satellite-framed and Verb-framed languages (Talmy 1991) with the help of specially designed "event triad" stimuli that pitted manner of motion and path of motion against each other.

7.1 Argument structure

7.1.1 Three-participant events

Both within and across languages, there is considerable variation in strategies for encoding three event participants – e.g., agent, theme, and recipient/benefactive, or agent, theme, and possessor of theme – within a single clause. To

explore crosslinguistic, developmental, and psycholinguistic aspects of this problem, a workshop entitled "The Linguistic Encoding of Three-Participant Events: Crosslinguistic and Developmental Perspectives", organized by project members P. Brown, Narasimhan, and Eisenbeiß, was held in May (see Chapter 13 for a list of participants). The following two studies were among the topics presented.

Enfield examined a type of monoclausal serial verb construction in Lao, the 'handling verb construction'. This features a 'handling verb' (usually 'take') in V1 position, and requires an agentive verb in V2 position:

- (1) NP1 - V1_{HANDLING} - NP2 - V2_{CONTROLLING/AGENTIVE} - (NP3)

A common use for the construction is to describe three-participant events, as in (2):

- (2) kuu3 qaw3 miit4 haj5 man2
 1sg take knife give 3sg
 'I gave a knife to him/her.'

But the construction also has application beyond three-participant events. Its most general function is to explicitly denote a 'pre-event' in which, prior to the main action, the referent of the subject argument comes into control over another participant; this can be a theme, instrument, or undergoer, depending on the valency of V2. More specific properties of the construction also depend on V2's valency. With a "2½-place" V2 (a verb with three semantic arguments but only two syntactic arguments), such as *thèeng2* 'stab', the construction supplies a new core argument slot for an instrument participant:

- (3) kuu3 qaw3 miit4 thèeng2 man2
 1sg take knife stab 3sg
 'I stabbed it/him/her with a knife.'

With a 2-place V2 (a verb with two semantic and two syntactic arguments) the construction does not add an argument, but it does add a subevent of 'coming into control' over this verb's patient argument, and brings the argument to a more prominent position before the main action verb. Compare (4b), where the construction is used, with (4a), where it is not; the two examples differ functionally in (among other things) the definiteness/specificity of the undergoer argument:

- (4) (a) kuu3 thim5 miit4
 1sg discard knife
 'I discarded the/a knife.'
 (b) kuu3 qaw3 miit4 thim5
 1sg take knife discard
 'I discarded the knife.'

Complex predicates, as in the handling-verb construction, make explicit reference to multiple subevents. The best known types add a 'post-event' such as a resultant state change or a 'co-event' such as posture. The Lao handling verb construction instead adds explicit reference to a 'pre-event' of the subject's coming into control.

Eisenbeiß and Matsuo investigated how learners of German and Japanese encode events in which there is mention of an agent, a body-part patient, and the possessor of the body part. Languages use different constructions to encode all three participants within a single clause. Japanese uses an internal possession construction (IPC), in which the agent-patient relation is realized at the VP level and the possessor-possessum relation is encoded independently within the patient NP:

- (5) Kirin-ga [[usagi-no] mimi]-o kan-da
 giraffe-Nom rabbit-Gen ear-Acc bite-Past
 'The giraffe bit the rabbit's ear.'

Comparable constructions are possible in German (see 6), but dispreferred in favor of an external possessor construction (EPC) (Payne & Barshi 1999) in which all three participants are integrated at the VP level, with the possessor as a dative-marked argument of the verb and the possessed body part occurring in a separate phrase, as in (7):

- (6) Die Giraffe beisst [ins Ohr [von dem Hasen]_{PP}]_{PP}
 the giraffe bites in the ear of the rabbit
 'The giraffe bites the rabbit's ear.'
- (7) Die Giraffe beisst [dem Hasen]_{DAT} [ins Ohr]_{PP}
 the giraffe bites the rabbit in the ear
 'The giraffe bites the rabbit in the ear.'

Eisenbeiß and Matsuo studied two types of scenarios involving a possessed body part: agent-patient scenarios (e.g., 'The giraffe bites the ear of the rabbit') and agent-theme-goal scenarios (e.g., 'The boy puts the saddle on the back of the horse'). For each language, they asked children aged two to six years to describe 10 pictures (5 for each of the two scenarios). The children exhibited the coding preferences of their target language: Japanese children used IPCs 99 percent of the time, whereas German children used both EPCs and IPCs, but preferred EPCs (87 percent). German children made far more errors with their preferred construction type (EPC) than Japanese children did with theirs (IPC) (24 percent compared to under 1 percent). For both sets of children, the more participants that had to be encoded, the more difficult it was to integrate them; e.g., only 4 percent of the German EPCs expressing agent-patient relations

showed errors, as opposed to 52 percent of EPCs expressing agent-theme-goal relations. On their IPC constructions, German children made many more word order errors than Japanese children, often preferring the non-target-like order possessor-possessum (which is correct in Japanese):

(8) Da legt der Junge die Leine auf Katzes Hals
 there lays the boy the leash on cat's neck
 'There the boy puts the leash on the cat's neck.'

In contrast, children never changed the possessor-possessum order of German EPCs and Japanese IPCs. These results suggest, first, that constructions that integrate several types of relations at the verb-phrase level are more difficult than constructions that realize the relations independently, and second, that children prefer the order possessor-possessum (see Eisenbeiß 2002 for evidence from other constructions).

7.1.2 Participant marking and verb morphology

Narasimhan investigated children's sensitivity to argument and event structure properties in their acquisition of agent case-marking in Hindi. According to semantic bootstrapping (the hypothesis that language learners use meaning to project aspects of form), children come equipped with innate linking rules that allow them to rely on participant roles – e.g., agent (of a transitive action), actor (of an intransitive action) – to acquire case-marking patterns (Grimshaw 1981, Pinker 1984). For example, learners of nominative-accusative languages would link both agents and actors to nominative case, while learners of ergative-absolutive languages would link agents to ergative case and actors to absolutive case. In Hindi, a split-ergative language, agents are not treated uniformly: when the verb is perfective they are marked with ergative case (the enclitic *ne*), but when it is imperfective they are "nominative" (null-marked), like actors. If the semantic bootstrapping account is correct, children learning a split-ergative pattern like that of Hindi would be predicted to initially overextend ergative case to agents in imperfective contexts, and possibly to those actors which are similar to agents in being controlling, active participants of actions (e.g., the single participants of actions such as "jumping" or "singing", as opposed to actions such as "dying" or "sleeping"). But Narasimhan finds no such overextensions: children correctly use ergative marking only for agent subjects of perfective verbs; their only errors are errors of omission. The lack of the predicted overextensions suggests that semantic bootstrapping accounts require modification.

O'Shannessy is carrying out her doctoral research on the acquisition of participant marking in an indigenous community in northern Australia where

children receive mixed bilingual input. The input languages are Warlpiri, an indigenous language, and Light Warlpiri, a new variety that systematically combines elements of Warlpiri, English, and Kriol (an English-based creole). In this situation, unlike most other bilingual situations reported in the literature, the input languages are not clearly separated, for example, by who the interlocutors are or where the interaction takes place. The input contains a considerable amount of code-switching and borrowing among languages. The study investigates the acquisition of the clausal core in both language varieties by children from 1;10 to 5 years – specifically, the treatment of ergative case marking and word order. Warlpiri relies on nominal case-marking and cross-referencing on the verbal auxiliary to indicate grammatical functions, and has free word order. In contrast, Light Warlpiri indicates grammatical functions mainly through SVO word order and partly through optional nominal case-marking.

To investigate the treatment of participant marking by children who receive this variable input, O'Shannessy is collecting both longitudinal and experimental data. The initial longitudinal data has been collected and consists of weekly recordings of five children aged 1;10 to 4;0 years, each interacting with several family members. The data are being analysed to compare the strategies children use to mark grammatical relations with the patterns displayed in the adult input. To determine whether children pay more attention to word order or case marking, children aged three, five, and seven years have been given an experimental comprehension task in Warlpiri; comparable data will also be collected in Light Warlpiri, and the results compared.

7.2 Event parsing and event categorization

How do languages divide up information in complex scenarios – e.g., hitting something so that it breaks, placing something so that it stands – and distribute it across elements within a clause? Which events do they treat as similar to one another – i.e., as instances of the same type of event? In 2003 project members devoted much attention to these issues of event parsing and categorization, and to how children acquire the patterns of their target language.

7.2.1 Complex predicates

Jidong Chen started her dissertation research on children's acquisition of verb compounding in Mandarin, a constrained but very productive process. A Mandarin verb compound is typically composed of two or three verb roots (V-V (-V)) and is characterized by rigid order and a tight relationship between the component verbs:

- (9) Zhang1san1 *ti1-po4* le men2.
 Zhangsan kick-break PERF door
 'Zhangsan broke the door by kicking it.'

Most frequent in adult speech are resultative verb compounds (RVC), used to encode causal events, and directional verb compounds (DVC), for motion events. RVCs denote a causal relationship between an action (V1) and a resulting state (V2); both verbs come from an open-ended set. DVCs are formed with a manner-of-motion verb (V1) followed by a path verb (V2) and/or a deictic verb (V2/V3); V2s and V3s come from closed sets. In analyses of constraints on the compounding process, Chen found that verbs of certain semantic types – e.g., cessation, posture, and manner-of-motion – resist being combined, as V2, with an action verb (V1) – for example, **la1-zhan4* 'pull-stand' (cause to stand by pulling) is not possible.

To investigate Mandarin children's sensitivity to the productivity of verb compounding, and constraints on it, Chen collected spontaneous speech data from children between 1;6 and 4;6 years, and elicited production and comprehension data with four sets of video stimuli from children between 2;6 and 6;1 years. She found that learners of Mandarin begin to produce verb compounds very early – as young as 1;7. By 2;6 they combine V1s and V2s flexibly, showing sensitivity to the combinatorial nature of verb compounds. But children of all age groups overshoot: on a game task, they both produce and accept novel verb compounds that adults reject, such as **la1-zhan4* 'pull-stand'. In a comprehension task, they show an adult-like interpretation of verb compounds as composites of both action and resultant state, but the children in the youngest group differ from adults in interpreting 'V1 (action verb) + *le* (perfective aspect)' as if a result is achieved, while adults clearly treat it as a mere completion of an action, regardless of the result. Other interesting errors were also observed, such as the ungrammatical use of progressive aspect with RVCs and the causative use of intransitive VCs.

O'Connor continued her dissertation research on expressions of change events in Lowland Chontal, an underdocumented and endangered unclassified language of southern Mexico. Last year she reported on the 'associated motion' construction, a type of complex predicate formed with derivational suffixes that links a subevent of deictic motion or state change to the predication of the main verb. A second major resource for expressing change events is the 'associated direction' construction. These are compound stem predicates consisting of an initial verbal element, which may or may not be a stand-alone verb, and at least one element specifying a direction or a topological relation, such as 'up, down, across, into'. The initial element describes something about the change event itself or about the semantic theme, and the directional element encodes the location or endpoint of motion or state-change. The semantics of these two elements combine in various ways to produce four subclasses of constructions,

each characterized by the meaning of the initial verbal element. *Trajectory* constructions elaborate the shape of the path followed by the moving entity as 'straight across' or curving horizontally or vertically. *Process* constructions describe the manner or cause of change, such as 'sliding', 'stabbing', 'planting', or 'breaking'. *Positional* constructions identify the posture or configuration of the theme, e.g., 'sitting', 'standing', 'lying', 'crouching', 'curled up', 'extended'. Finally, *classificatory* constructions use classifier initial elements to index the shape, size, or identity of the theme as, for instance, 'small', 'long and thin', 'human', 'corn or grain', or 'container'. A construction analysis captures the common formal composition of the complex predicates and locates the semantics of motion or change in the constructional meaning. In discourse, 'associated direction' constructions often play a role in referent-tracking, and they can serve an adverbial function.

7.2.2 Event categorization

7.2.2.1 "Cutting and breaking"

Bowerman and Majid, in collaboration with van Staden (U. Amsterdam) and Boster (U. Connecticut, Storrs), continued work on the "Cut and Break" project, a large-scale comparative study that explores the semantic and syntactic encoding of actions of cutting, breaking, and other kinds of separation across a wide range of genetically and areally diverse languages. With contributions from project members and other colleagues, descriptions of a standardized set of video-taped actions have now been collected from speakers of 28 languages. Last year's Annual Report (pp. 119-121) presented syntactic analyses of a subset of these data sets, focusing on crosslinguistic agreement and variation in whether speakers encoded the events with single monomorphemic verbs (e.g., 'cut') or with complex constructions (e.g., 'hit-break', 'cut off', 'break_{intr}-CAUSE'). Work in 2003 addressed the semantic structuring of this domain, asking how speakers of the various languages implicitly classified the events through the verbs they used to encode them with.

Although the verbs *cut* and *break* and their 'translation equivalents' have often figured in discussions of predicate semantics, their core meanings have usually been left unexplained (they are often symbolized simply as an unanalyzed "constant", as in 'x CAUSE [y BECOME *BROKEN*]'). What does it mean, then, for someone to "break" something? To "cut" something? Do all languages recognize the same categories of events in this domain? To find out, Bowerman, Majid, Boster, and van Staden treated the data of the Cut and Break project as analogous to the data obtained in a sorting study. In a typical sorting study, a subject might be asked to sort a set of cards, each with a different stimulus on

it, into piles of stimuli that "go together". In the Cut and Break project, speakers are asked to describe the stimulus events, and each different linguistic form (e.g., a word or a word combination) they produce is taken to define a category for them. Across subjects both within and across languages, stimuli that are often described with the same linguistic forms (equivalent to "are sorted into the same pile") can be considered more similar to each other (from the perspective of linguistic categorization) than stimuli that are described with different linguistic forms (Bowerman 1996). Seen in this way, the data can be analyzed with multivariate statistics suitable for similarity data, such as multidimensional scaling, correspondence analysis, and cluster analysis.

Multivariate analyses of the Cut and Break data reveal both agreement and variation across languages in the semantic partitioning of this domain. Overall, languages recognize one or more categories of events of "peeling" and "opening", distinguishing these stimuli from a core set of events involving the material destruction of objects. For events of material destruction, languages also agree in recognizing a dimension to do with the agent's degree of control over the point of separation in the patient's integrity (e.g., English *cut* involves fine control, *break* does not). At the same time, there is striking variation in how many categories are recognized within this structured semantic space, and where the boundaries between categories are positioned.

In a spin-off of the Cut and Break project ("Kids' Cut and Break"), project members asked how children acquire the categories of "cutting and breaking" they need for their target language. In her M.A. thesis research, Erkelens (now at U. Amsterdam), working together with Bowerman and Majid, created a shorter and child-friendlier version of the "cut and break" stimulus set, and used it to collect data from Dutch speakers in three age groups: four-year-olds, six-year-olds, and adults. Parallel sets of Kids' Cut and Break data were also collected for Mandarin by Chen and for Tamil by Narasimhan. Multivariate analyses of these data sets reveal the importance of the same dimensions identified in the larger-scale adult project, and show that children approximate the target categorization very early (see Erkelens 2003 for a full analysis of the Dutch data).

7.2.2.2. Caused motion events

Continuing prior research within this project on placement events (Annual Report 2002:123-124), Narasimhan and Gullberg examined the role of animacy and orientation in the use of caused positional expressions in children acquiring Tamil. In Tamil, placement events are typically encoded using a general verb of placement (*veyyii* 'put'); the use of a caused positional (e.g., *nikka veyyii* 'make

stand'; *paD|Ukka veyyii* 'make lie') is relatively marked. Four-year-olds, six-year-olds, and adults were asked to describe sixteen video clips of actions of placing animate and inanimate objects in either a vertical or horizontal position. Adults used a caused positional most frequently when the object was animate. The four- and six-year-olds tuned in early to this link between animacy and the use of caused positionals in the input, but even in later childhood, children are still developing sensitivity to the factors underlying preferred patterns of use in adult language: the six-year-olds – but not four-year-olds or adults – often used caused positionals not only for animates but also for inanimate objects placed vertically, suggesting that the relative roles of animacy and orientation in triggering the use of caused positionals shift over time. In a broader study of lexical semantic patterns in encoding placement events in both adults and children, the Tamil data are now being compared to data from child and adult speakers of Dutch, where caused positionals (e.g., *zetten* 'set, stand', *leggen* 'lay') are the default option for specifying placement events. This crosslinguistic research – carried out in cooperation with the Dynamics of Multilingual Processing Project – also examines the relationship between the use of such verbs and co-speech gestures encoding position.

7.2.2.3 Reciprocal events

There is a new subproject "Reciprocals across Languages" in collaboration with Evans (U. Melbourne). One of its goals is to bridge the gap between research on reciprocity carried out within generative and formal semantic traditions on the one hand and cognitive/ functionalist approaches on the other. In particular, the insights gained into reciprocals in English and other European languages by applying the research methods of the generative tradition need to be grounded in a broader language base to be useful for making typological generalizations. In a preliminary investigation, Gaby examined the relationship of reciprocity and its linguistic representation using data supplied by colleagues on English (Gaby), Kilivila (Senft), Kuuk Thaayorre (Gaby), Lao (Enfield), Lavukalave (Terrill), Mirañña (Seifart), Tzeltal (P. Brown), Warlpiri (O'Shannessy) and Yélî Dnye (Levinson). Initial results suggest that the semantically most general reciprocal constructions (used to mark the largest number of reciprocal relation types) are those involving reciprocal pronouns. When reciprocity is marked by a verbal suffix, the semantic range is more restricted; markers taking the form of a noun-like verbal enclitic seem to have an intermediate range of application (see Figure 7.1.)

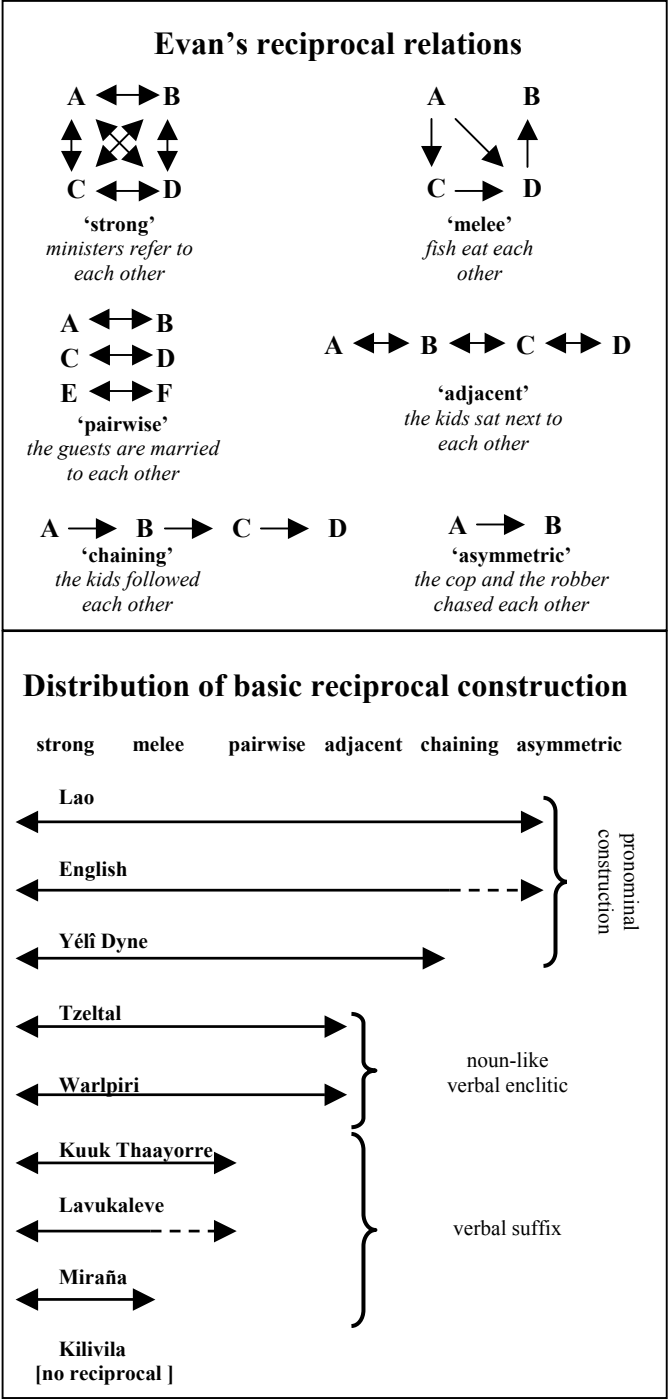


Figure 7.1

7.2.2.4. Event categorization in language and nonlinguistic cognition

Bohnenmeyer, Eisenbeiß, and Narasimhan conducted a crosslinguistic study to investigate whether language-specific ways of encoding motion events influence nonlinguistic cognition. According to Talmy (1991), languages can be divided into two groups on the basis of their characteristic pattern for encoding motion events:

- (10) V(erb)-framed: PATH encoded in verb, MANNER in optional constituent
The ball entered the cave rolling.
- (11) S(atellite)-framed: MANNER encoded in verb, PATH in verb satellite
The ball rolled into the cave.

Slobin (1996, Berman & Slobin 1994) have demonstrated that these differences affect "thinking for speaking" – mental processes recruited in the course of using language. Testing the stronger claim that language affects *nonlinguistic* cognition, Gennari et al. (2002) and Papafragou et al. (2002) found that performance on nonlinguistic categorization tasks does not reflect language-specific influences (although there was an effect of prior verbal encoding of the motion event). But these latter two studies are limited in that they compare only two languages and treat manner and path monolithically, ignoring distinctions in types of path (e.g., direction; presence of boundary-crossing) and in manner (e.g., whether the motion is self-propelled [e.g., *walk* versus *slide*] and whether translational motion is implied [e.g., *slide*, *walk* versus *spin*, *bounce*]).

Bohnenmeyer et al. designed a set of motion event triads that systematically varied manners and paths. With the help of project members and other colleagues, they collected nonlinguistic similarity judgments from 12 speakers of each of 15 typologically diverse language: 12 V-framed: Basque (Ibarretxe, U. Deusto), Catalan (Bohnenmeyer), Hindi (Narasimhan), Italian (Bohnenmeyer), Jalonke (Lüpke), Japanese (Kita), Lao (Enfield), Spanish (Bohnenmeyer), Tamil (Narasimhan), Turkish (Özyürek, Koç U.), Tidore (van Staden), Yukatek (Bohnenmeyer); and 3 S-framed: Tiriyo (Meira), Dutch (Bohnenmeyer), German (Samland, U. Bremen). Participants viewed a target motion event (e.g., ball rolling up ramp), followed by two events that changed either *manner* (e.g., ball *sliding* up ramp) or *path* (e.g., ball rolling *down* ramp). Speakers judged which of the two events was more similar to the target. The hypothesis was that speakers of S-framed languages would prefer to match on manner, and speakers of V-framed languages on path.

There was a significant effect of language on judgments, but it was not based on the S-framed versus V-framed distinction. Rather, there was intratypological

variation: some V-framed languages were associated with a "high manner preference" and others with a "low manner preference"; the S-framed languages were intermediate, and did not differ significantly from either group. There were significant effects of fine-grained differences in path and manner. For path type the effects were independent of language: triads that involved a vertical (*up-down*) path were associated with a significantly lower manner preference overall than triads with a horizontal path (*left-right* paths both with and without boundary-crossing). But for manner contrasts, effects varied according to language; for instance, German speakers gave a lower proportion of manner matches when the contrast was *rolling* versus *sliding* than when it was *rolling* versus *spinning*, while Spanish speakers showed the opposite pattern. Research is planned to further explore the basis for this intratypological variation – e.g., the possible role of language-specific lexical effects.

8 THE ROLE OF FINITENESS

Introduction

8.1 What is finiteness?

8.2 How is finiteness acquired?

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Joint research with other projects:

The Dynamics of Learner Varieties

Event Representation

The project focuses on the structure and the functioning of a verbal category which has recently found considerable attention in first as well as in second language acquisition – finiteness. 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 to be finite, all others are considered as nonfinite. This view, however, 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, by far most English verb forms can be finite as well as nonfinite. Second, there is a number of syntactic, semantic and pragmatic phenomena which are clearly associated with the presence or absence of finiteness. These include, for example, basic word order rules, the licensing of grammatical subjects and of expletive elements, constraints of 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 the negation *not* and other 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.

8.1 What is finiteness?

In many languages, finiteness is more or less clearly marked on the verb. But this marking cannot explain structural constraints such as (1):

- (1) ONE FINITE ELEMENT CONSTRAINT: a syntactically complex verb form can contain several nonfinite forms but maximally one finite form.

This constraint is one out of many structural correlates of the finiteness distinction. Klein analyzed a number of these constraints in German. When taken together, they suggest an incipient picture of a category which is fundamental to the organization of utterances in human language. There are at least three salient finiteness effects in German syntax. One of these concerns basic word order, which is determined by three rules:

- (2) a. In declarative clauses, the finite verb is in second position.
 b. In subordinate clauses, the finite verb is in final position.
 c. In yes-no questions and in imperatives, the finite verb is in initial position.

These rules have nothing to do with the verb as a lexical unit, as becomes clear when lexical verb and finiteness marking are realized by two separate forms. Then, the lexical verb is regularly at the end, and it is the carrier of finiteness

which obeys (2a-c). Note that the variation in the position of finiteness is strongly correlated with the 'assertive status' of the sentence: only sentences with finiteness marking in second position can be declarative.

A second syntactic correlate of finiteness is 'gapping', a rule which is traditionally associated with the verb; it says that in coordinations, an identical verb can be omitted on the second occurrence as in (3):

- (3) Maria trank ein Bier und Peter (trank) einen Wein.
 'Maria drank a beer and Peter (drank) a wine.'

But examples such as (4) and (5) show that this effect is actually due to the finiteness marker, rather than to the lexical verb.

- (4) Maria ist gestern abgereist und Peter (ist) heute angekommen.
 Maria is yesterday left and Peter (is) today arrived
 'Maria left yesterday and Peter arrived today.'
- (5) Maria war gestern abgereist und Peter ist heute *(abgereist).
 Maria was yesterday left and Peter is today *(left)
 'Maria left yesterday and Peter left today.'

A third syntactic effect of finiteness concerns the licensing of subjects and expletives in German. Roughly, there is no grammatical subject without finiteness, and there is no expletive without finiteness. There are a few exceptions, such as *Hans ein Glas Wein trinken - das kann ich nicht glauben*. Interestingly, these lack an assertive status. Thus, it appears that finiteness is somehow related to the 'illocutionary status' and the 'topic-status of constituents' of the utterance.

There are also clear semantic effects. The distinction between opaque and transparent verbs disappears when the verb is not finite. In *Arthur found a unicorn*, the object NP must be specific, whereas in *Finding a unicorn is great*, it has a specific as well as a nonspecific reading - except it is in the scope of a 'higher' finite verb, as in *The knights succeeded in finding a unicorn*. Thus, we have a

- (6) FINITENESS CONSTRAINT ON SPECIFICITY: indefinite noun phrases have a specific reading only if they are - directly or indirectly - in the scope of a finite verb.

Examples such as *Three times, Arthur found a unicorn* (in contrast to *Arthur found a unicorn three times*) show that this specificity is relative to the 'time talked about' or 'topic time'. Second, finiteness marking carries the tense information of a clause. Examples such as *(Why didn't she come to the meeting*

yesterday?) - *She was ill.* show that this 'finiteness time' does not relate the situation (her being ill) to the moment of speech but the 'topic time' (her being ill can easily include the moment of speech). Tense marking, in turn, is typically combined with the assertive function of the clause, as is shown when the finite component is prosodically highlighted. Thus, main stress on *was* in (7a) indicates a temporal as well as an assertive contrast:

- (7) a. (The curtain is in the shower.) - That's wrong, the curtain **WAS** in the shower (but isn't any longer).
 b. (The curtain was not in the shower.) - That's wrong, the curtain **WAS** in the shower.

These and related observations suggest an incipient picture of finiteness which can be summed up as follows. A full finite sentence consists of three components. First, there must be a specification of the situation about which the utterance says something - the 'topic component'. Minimally, it includes a 'topic time'; this is the time to which the assertion (or whichever the illocutionary role is) is confined. It may also contain a 'topic world', a 'topic place' and a 'topic entity', typically realized by the grammatical subject. Second, there must be a 'sentence base', i.e., a nonfinite verb and minimally an appropriate filling of its argument slots. And third, there must be a marking which links the sentence base to the topic component - and this is 'finiteness'. Very often, this linker is expressed by verb inflection; but other languages may use different devices.

8.2 How is finiteness acquired?

8.2.1 Acquisition of participles

Matsuo investigated how Dutch speaking children interpret present and perfective participles used attributively, as in *burning/burned candle*, *boiling/boiled water*, *melting/melted ice cream*. These participles exhibit an aspectual distinction between ongoing and completion as discussed in Klein (2002).

Twenty-five Dutch children between 2;0 and 5;9 participated in the first experiment using a sentence-to-scene matching task. Sixty-four Dutch children between 4;4 and 9;11 plus seven adults participated in the second experiment, employing the grammaticality judgement task. Both experiments investigated whether Dutch children know the aspectual distinction in adjectival participles. The two experiments support prior results in Wagner (2002) which indicate that children who are younger than 4 years old indeed have problems in the interpretation of grammatical aspect morphology. The results also revealed that the children older than 4 still have problems in present and perfective participles

when the experiment was modified by adding an intermediate stage. It was found that even 9-year-olds were not sure whether an intermediate stage went with present or perfective participles.

8.2.2 Acquisition of finiteness in Dutch-findings on L1 and L2 learners

Jordens continued his research in the acquisition of finiteness, which turns out to be a major task in child language acquisition and in the development of adult bilingualism. As shown in Klein (1998), finiteness may be construed as the expression of illocutionary force. In early Dutch learner varieties illocutionary force is expressed by elements with adjunct function. They occur as part of a language system, which is based on principles of information structuring. This language system enables learners to produce utterances with a *topic* which refers to the spatio-temporal and/or personal anchoring point that the utterance is about, a *predicate* which refers to a particular state of affairs that is claimed to hold for the topic and a *linking element* which qualifies (validates) the relation between the predicate and the topic in terms of its illocutive function. Examples of early spontaneous production data are given in (8):

(8) child L1 Dutch			adult L2 Dutch		
TOPIC	LINK	PRED	TOPIC	LINK	PRED
Peter	moet	zitte	muslim	kan	roken
('Peter must sit')			('muslim can smoke')		
dit	nee	afdoen	dan	mag	niet rijden
('this no off-do')			('then may not drive')		
mama	kanniet	kusje	mijn vader	niet	werken
('mommy can not kiss')			('my father not work')		

In early L1 and L2 Dutch, there is no functional category system to account for the morpho-syntactic properties of finiteness in the target language. A system of illocutive markers is used to express illocutionary force. As shown in (9) there is a distributional opposition between illocutive markers with a positive and a negative meaning.

(9) ulle; mag-ikke?	('want, may-I')	nee	('want-not')	Volition
kan (wel)	('can-indeed')	kan nie(t)	('can-not')	Ability/Apology
mag (wel)	('may-indeed')	ma(g)niet	('may-not')	Permission
moet	('has-to')	hoe(f)niet	('has-to-not')	Obligation
doetie, gaatie	('does-he, goes-he')	niet	('not')	Assertion

At the relevant stage, both the L1 and L2 learner systems also allow for some variation in word order as illustrated in (10):

- (10) a) JAJA mag dop opdoen ('J may lid onto')
 b). DISSE hoeniet meeneme ('this have-to-not with take')
 c). O mag deur opemake ('may door open make')
 d). O kanniet pakke ('cannot get')
 *e). DIE magniet JAJA hebbe ('that may not J have')
 *f). DIE mag JAJA hebbe ('that may J have')

Predicates as in (10) refer to causative actions. As shown in (10a) and (10b) the object may or may not occur in topic position. If elements with topic function can be inferred from context, as in (10c) and (10d), they can be left unexpressed. At the relevant stage, utterances as in (10e) and (10f) seem to be excluded. This is due to the information-structural functioning of the current system. That is, it is impossible for an agent and a verb to function as a predicate.

Analyses of spontaneous child L1 and adult L2 production data provide evidence of a crucial role for the acquisition of the auxiliaries *heb/heeft* and *ben/is* + past-participle verb (Jordens 2002). It leads to a reanalysis of the illocutive markers as elements of the syntactic category AUX and, consequently, a restructuring of the learner language. First, the illocutionary function of the linking element is expressed either by the finite auxiliary verbs *heb/heeft* and *ben/is* or by target-like modal verbs. This explains, for example, why *nee* as a negative illocutive marker suddenly disappears. Second, lexical elements such as *niet*, *wel* and *ook* do not occur with linking function any more. Given that *niet*, *wel* and *ook* now function independently as elements with properties of scope they may occur as adjuncts before their domain of application, i.e. the predicate. These observations are evidence that learners discriminate between a category of auxiliary verbs and a category of adjuncts with scope over the predicate. They show that utterance structure is based on a syntactic structure which entails both properties of the lexical-semantic and the functional category system. It accounts for the fact that at the relevant stage both L1 and L2 learners of Dutch are able to produce utterances with topicalization and verb-second as in (11):

- | (11) child L1 Dutch | adult L2 Dutch |
|--|--|
| DIE heef mama maakt
(('that has mommy made')) | DIE heb ik hier gedaan
(('that have I here done')) |
| DA mag papa wel doen
(('that may daddy indeed do')) | DAT heb ik nooit gezegd
(('that have I never said')) |
| DAN moet C weer make
(('then has-to C again make')) | DAN ga ik mijn familie wonen
(('then go I my family live')) |
| ZO kan J niks zien
(('this-way can J nothing see')) | DAN moet ik huis zoeken
(('then have-to I house look-for')) |

8.2.3 Acquisition of finiteness in Dutch-findings on normally developing and SLI children

Jolink continued longitudinal research on the acquisition of the structural and functional properties of finiteness in Dutch. She studied six normally developing (ND) Dutch 2-year-olds as well as 2 Dutch 4-year-olds with specific language impairment (SLI) of age 4. For these subjects both spontaneous and elicited speech data were collected for a period of one year.

An analysis of the spontaneous speech data from the first three months of the study suggests that neither the ND subjects nor the SLI subjects have yet reached the stage at which the link between topic and predicate is systematically marked by means of a grammatical element, such as a finite lexical verb, a copula or an auxiliary. In fact, during this period the majority of utterances are still verbless.

For the ND children, however, there is a decrease in the percentage of verbless utterances and an increase in the percentage of both finite and nonfinite verb-containing utterances over three months.

For the SLI children the percentage of verbless, finite and nonfinite utterances remains stable over time. Instead, their performance seems to be influenced by the discourse situation: they use more verb-containing utterances when the discourse setting is informal.

The subjects at this stage express assertions, but do not necessarily do so through an utterance with a (finite) verb. However, some ND children at this nonfinite stage use and even emphasize the finite verb to stress an assertion as in (12):

- (12) DÓE DAT! '(I will) do it (even though you don't want me to)'
 ÍS GROTE '(this) is a big one (contrary to the one we just talked about)'

Adult speakers would use particles like 'wel' ('indeed') or 'toch' ('all the same') in these cases, but the ND subjects have not yet acquired these particular lexical items and therefore use an alternative method. This could suggest that, at this nonfinite stage, the ND subjects already perceive elements expressing an activity or state as a possible candidate for assertion marking.

8.2.4 Acquisition of finiteness in French and Japanese

Jordens, Matsuo and Perdue undertook a project to investigate the validity of the conceptual ordering stage addressed in Dimroth et al. (2003) and Dimroth and Jordens (2001), which propose a stage model for the (first and second) language development of finiteness. The proposed order: Topic–Link–Predicate corresponds to the predominant declarative surface ordering of V2 languages

such as German and Dutch.

They started the investigation of the acquisition of nonrelated languages (such as Japanese and French) to ascertain more precisely the influence of the surface ordering of input utterances on the constituent order of child utterances. They chose French and Japanese because in French, the discourse context can provoke surface orders which are different from the Germanic conceptual ordering and in Japanese, a combination of syntax (SOV) and discourse context provokes a systematic difference from Germanic conceptual ordering.

Both the French and Japanese data come from the CHILDES database (MacWhinney 2000). The French set consists of 2 files of Grégoire between 1;9.18 to 1;9.28. Grégoire's MLU is 1.87. The Japanese data set consists of the 12 files of Jun by Ishii (1999); it is from the period between 1;11 and 2;2. Jun's MLU is 1.29 at 1;11 and it slowly goes up to 1.57 at 2;2.

It was found that these children's productions show a clear influence of the surface ordering of spoken Japanese and French. In Jun's production, the linking element always occurred after the predicate; in Grégoire's, the topic element very often occurred in utterance-final position (the 'antitopic' of spoken French). Thus the *ordering* 'Topic-Link-Predicate' is not universal. However, the *semantic organization* of these children's utterances showed at first blush a distinct relationship with previous analyses, in that the three constituents were indeed present in their utterances, fulfilling the same functions, albeit in different surface orderings.

8.2.5 Acquisition of finiteness in Russian

Kirsch continued her research on the role of lexically empty and full verbs in the acquisition of finiteness in Russian as a first language. Kirsch investigates whether the observed crucial role of protomodals and auxiliaries for the acquisition of finiteness in Germanic languages can be observed in a typologically different language as well.

In relevant studies (Bar-Shalom 1998; Gagarina 2002) Russian is classified as a so-called Root Infinitive (RI) language. It is suggested that Russian children go through a stage where they use nonfinite verb forms in root clauses. On the basis of the analyzed longitudinal corpus data of two Russian children, Kirsch argues for a minor role of the infinitive forms which are used for reference to ongoing or past events. She suggests that although some children acquiring Russian might go through a stage where they use nonfinite forms where adults would use finite forms; this stage is not obligatory for all Russian children. Moreover, this stage is not as extended as it is in children acquiring a Germanic language.

Two factors suggest that the auxiliary status of the verb is not the decisive factor triggering the acquisition of finiteness in Russian. One is the typological difference of the Russian target language concerning the distribution of lexically empty verbs in contrast to the Germanic languages, and the other is the small amount of nonmodal usage of RIs in the L1 corpus data.

Still, the question remains: how do Russian children find out which verbs can be used as support verbs - and thereby bind the Finiteness Component and give up most of their lexical content in the language they are learning? Of particular interest is the light verb "delat'" (to make/to do) in the data of two Russian children. These children on some occasions combined "delat'" with another lexical verb in the same utterance, which is ungrammatical in their target language and is not supported by the input the children received. An elicitation study has been started to investigate this phenomenon on a broader basis.

9 THE DYNAMICS OF MULTILINGUAL PROCESSING

Introduction:

- 9.1 The effects of exposure to an unknown L2+
- 9.2 The dynamics of the transition towards automatic processing of L2+
- 9.3 The interaction of L1 and L2+ processes in the proficient speaker

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Collaborations with other projects:

Phonological Learning for Speech Perception
Multimodal Interaction
Space
The Dynamics of Learner Varieties
Event Representation
Pioneers of Island Melanesia

The second half of 2003 saw the start of a new Institute project on multilingual language processing. The project is sponsored by a grant from the Netherlands Organisation of Scientific Research (NWO). In this project, which is headed by Gullberg and Indefrey, the following researchers participate: Davidson, F. Hellwig, Jongejan, Roberts, and Sahin. In October, two Ph.D. students, Amanda Brown and Sabine Schneider joined the group. The purpose of the project is to study the processing of second and third languages (L2+) during first contact, during acquisition and in the stabilized end state of high proficiency. These aspects of L2+ processing will be explored using different methodological approaches, including reaction time and eye-tracking experiments, gesture analysis, and neuroimaging techniques (fMRI, ERP). The project is situated in part at the F. C. Donders Centre for Cognitive Neuroimaging.

9.1 The effects of exposure to an unknown L2+

In this subproject, Dimroth and Gullberg focus on the earliest perception and processing of input in an unknown L2+. Native Dutch listeners will be exposed to 15 minutes of controlled input in Mandarin Chinese, an unknown, typologically unrelated L2+. Phonological, semantic, and syntactic tests will provide information on the exact nature of the acquired knowledge and on the optimal combinations of parameters needed to extract this knowledge, such as context information, item frequency, gestural deictic links between sound and context, and amount of exposure. The input texts, in the form of weather reports as exemplified below, have been completed (*SMALL CAPS* = target item; C=content word; F=function word; Freq=frequent; G=gesture).

- (1) *QIAN-FENG* huan-huan qian-xing. *CONG* cheng xi kai-shi. *XIANG* Nanhai fa-zhan.
 The *FRONT* (C, Freq, -G) will move ahead slowly. It starts *FROM* (F, Freq, -G) the west of the city. It moves *TOWARDS* (F, + Freq, +G) Nanhai.

Dimroth, Gullberg, and Roberts have also developed a word recognition task, and a double set of sound-to-meaning mapping tasks for nouns versus verbs and functional elements separately.

9.2 The dynamics of the transition towards automatic processing of L2+

The focus of this subproject is on longitudinal studies of morphosyntactic processing of L2+. ERP, fMRI and reaction time studies will be conducted to investigate the time course of functional and neurophysiological developments during acquisition.

9.2.1 Neural correlates of L2+ syntactic processing

Hemodynamic studies comparing L1 and L2 processing have shown different L2 brain activation patterns for proficient and less proficient L2 speakers, suggesting a cerebral reorganization during L2 acquisition. To investigate whether this general observation also holds for syntactic processing and to determine the time course of a possible reorganization. Indefrey and F. Hellwig designed a longitudinal fMRI experiment on Dutch L2+ syntactic encoding and parsing. They adapted a scene description paradigm originally developed for PET studies of German L1 syntactic processing (Annual Report 2001:36). A pilot study with Dutch native speakers is currently underway.

9.2.2 Real-time processing of L2+ morphosyntactic features

Existing electrophysiological research on multilingual sentence processing has shown that event-related responses to grammatical and semantic violations are delayed or absent in multilingual comprehenders for sentences that are presented in the comprehender's second language. This has been interpreted as a corresponding delay or absence in the ability to use syntactic and semantic information during real-time sentence processing. To better understand the acquisition of effective parsing and interpretation processes in a second language, Davidson and Indefrey in collaboration with Hagoort (F.C. Donders Centre) designed a longitudinal study to examine the profile of ERP responses to semantic and syntactic violations during the acquisition of Dutch. This study is ongoing, and will track the development of these learners over the course of several years.

9.3 The interaction of L1 and L2+ processes in the proficient speaker

9.3.1 Interactions in multilingual syntactic processing

The purpose of this set of studies is to investigate L1-L2+ interactions in the highly proficient L2+ speaker at the level of syntactic processing, focusing at present on Turkish-Dutch bilinguals and highly advanced Turkish L2 learners of Dutch. Roberts, Indefrey, and Gullberg designed an eye-tracking experiment using both Turkish and Dutch stimuli, to examine these learners' real-time processing of a range of constructions which contrast between the two languages. An example of one syntactic contrast exploited in this study is the use of overt subject pronouns. In Dutch overt subject pronouns are obligatory, whereas in Turkish they are optional, their use being governed by pragmatic factors. The following example illustrates how the overt subject pronoun is used in order to corefer with a nonlocal referent:

(2) Erol ve Hans ofiste oturuyorlar.

Erol and Hans are in the office.

(a) Erol çalışırken, _ yiyor.

While Erol is working, he (*EROL*) is eating.

(b) Erol çalışırken, o yiyor.

While Erol is working, he (*HANS*) is eating.

In (a) where there is no overt subject pronoun, the subject of the second clause is the referent active in the current discourse, *Erol*, whereas in (b) the use of the overt pronoun signals a distinct referent, in this case *Hans*. In the Dutch versions of these sentences, (a) is ungrammatical, since no overt pronoun is present, in contrast to (b) which is fully grammatical. However, even though (b) is grammatical in both Turkish and Dutch, the referent for the subject of the second clause is different; in Turkish it is *Hans* whereas in Dutch it is the most local referent *Erol*. Therefore for the monolingual speakers of each language, differences in the on-line processing performance as well as the off-line interpretation of these types of constructions are predicted. To examine fully any potential L1-L2 interactions in the learner's processing of such syntactic contrasts, all participants also undertake acceptability judgement tasks and a comprehension questionnaire, in order that both their on- and off-line processing performance can be directly compared to the monolingual groups of both languages. Data collection is currently underway.

9.3.2 Interactions in multilingual processing at the conceptual/semantic interface

This line of study focuses on semantic interaction or semantic processing economy in the production and comprehension of advanced learners or functional bilinguals. In a pilot study, Gullberg used gesture analysis to investigate the potential reorganization of semantic representations in the domain of placement events (cf. Event Representation) in the production of advanced Dutch learners of French. Dutch and French show different levels of granularity in this domain. French uses a general placement verb, *mettre*, 'put'. Dutch obligatorily uses one of a set of caused positional verbs (*zetten*, 'set', *leggen*, 'lay'), the choice of which hinges on properties in the figure object (Annual Report 2002:86-88). A first substudy established that the language-specific event perspective is visible in the gestures of native speakers. Gestures accompanying French descriptions encode only the direction of the placement. Dutch gestures, however, consistently incorporate figure object information in specific handshapes, reflecting the necessary focus on figure objects for speech encoding. A second substudy investigated Dutch advanced learners of French. The logic was that reorganization of meaning representations to fit French

should result in French-like gestures. The results showed that while learners' speech was target-like, their gestures revealed traces of semantic organization from both languages: Dutch handshapes for incorporated figure objects, as well as French simple direction of placement. The gesture evidence suggests that the systems interact. The findings can be interpreted as an influence of the L1 on the L2 seen as transfer or incomplete acquisition. An alternative reading would suggest an enriched representation in the minds of advanced learners.

9.3.3 Complex interactions in multilingual processing: code-switching

Code-switching offers a special perspective on parallel processing in two languages. The rapid switching from one language to another midstream is an indication that two coexisting language systems are on-line simultaneously. In order to investigate postulated structural constraints on code-switching experimentally, Gullberg, Indefrey, and Muysken developed a paradigm for induced code-switching. Four tasks were designed to elicit baseline or validation data from Dutch-Papiamentu bilinguals. Baseline code-switching data was collected in natural four-party conversations, and in a director-matcher task. Dutch baseline data was provided by the same director-matcher task, and a Dutch proficiency measure from a standardized proficiency test (NT2 Staatsexamen). Two experimental tasks were developed to induce code-switching: a picture naming task and a shadowing task. A metalinguistic judgement task was also added. To accommodate for the social sensitivity of the phenomenon, most production tasks required at least two subjects to be present. To control for language mode, the experimenters gave the instructions either in code-switched or monolingual mode depending on the task. All subjects performed all seven tasks, allowing for unique within- and between-subject comparisons. The data collection is completed and the data treatment and analysis is in progress. The preliminary findings suggest that data from the experimental tasks reflect the natural switches in the code-switch baseline in terms of both locations and number of switches.

10 THE DYNAMICS OF LEARNER VARIETIES

Introduction

- 10.1 The acquisition of finiteness and temporality
- 10.2 The age factor in L2 acquisition

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Joint research with other projects:

The Dynamics of Multilingual Processing

Introduction

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 (Free U.), 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 set-up.

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 specific 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 2001:114), 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 2001:112). Focalization or topicalization devices emerge where the information structure of utterances in the Basic Variety is at variance with the discourse-dependent informational status of some utterance component (see Murcia-Serra, Annual Report 2000:117), or with the intended scope of some operator, e.g., negation (see Becker, Annual Report 2001:115). Some of these developmental steps are a prerequisite for the acquisition of other features. The successful integration of scope particles and temporal adverbials, for example, were shown to be dependent on the acquisition of finiteness and certain temporal features (see Benazzo, Annual Report 2000:114, and Dimroth, Annual Report 2000:112).

These assumptions continue 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. Rather than focusing on the process of L2 acquisition in adult learners alone, many researchers in the project are working on a comparison of first and second language acquisition.

As a consequence, new types of naturalistic and experimental data collections have been added to the large corpus of the ESF project. These more recent data sets allow a close comparison between the construction of discourse in first (L1) and second (L2) languages (project *Construction du discours par des apprenants des langues, enfants et adultes*, U. Paris VIII), the study of untutored L2 acquisition in children and adolescents (DaZ-AF project, MPI and U. Köln, see 10.2), and the study of ultimate attainment in very advanced adult second language learners (Advanced learner languages under a crosslinguistic perspective, U. Heidelberg).

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 longstanding questions (a) how second language acquisition differs from first language acquisition, and (b) how second language acquisition in children differs from second language acquisition in adults. The common assumption is that the developmental paths of first and second language acquisition differ greatly. The results summarized in the following reports draw a more complex picture. Early first and second language learners can be shown to produce amazingly similar structures even though this might be for different reasons. This has been investigated in particular for the acquisition of finiteness (see the reports of Bernini and Perdue below, and compare Jordens, Perdue, and Matsuo on L1 acquisition in Chapter 8.2).

A big difference between the two types of acquisition lies of course in the fact that L2 acquisition might be influenced by the availability of L1 knowledge. Experience with language acquisition and use might speed the acquisition process up. Child L2 learners can thereby even outperform L1 learners (Dimroth). Depending on (i) the closeness of the concepts encoded in L1 and L2, and (ii) the similarity of the respective markings, source language influence can positively or negatively affect different stages of the L2 acquisition process (Schmiedtová). Pagonis, in his dissertation proposal, addresses the question of whether younger and older L2 learners differ especially in those areas of target language morphosyntax that have only little communicative value.

The work of Dimroth, Perdue, and Schmiedtová was done at the Institute itself. The work of Bernini and Pagonis was carried out at other institutions.

10.1 The acquisition of finiteness and temporality

Bernini studied the development of the means for the expression of finiteness. As evidenced by nontarget uses attested in the acquisition of different languages, such as German, Dutch and Italian, the copula seems to play a central role in the acquisition of finiteness. In initial postbasic varieties of Italian, in particular, the copula appears to be employed by some learners as a kind of auxiliary in order to compensate for the absence of inflectional morphology with verbs.

- (1) io [...] sono è da razza cinese
I am is from race Chinese
'I am a Chinese' (Peter)

Similar periphrastic constructions autonomously elaborated by the learners are also attested in advanced post-basic varieties, although sporadically. In all of these constructions lexicon and grammar are kept apart and the labour of expressing verbal categories related to finiteness such as tense and modality falls upon the auxiliary-copula. In this respect, the copula helps the learner to bridge the gap between the basic stage with no inflected verb forms and finiteness expressed by other means, and the advanced post-basic stage with synthetic verb forms inflected for tense, aspect and modality as carriers of utterance finiteness as in the target language. As for the lexical component of auxiliary-copula constructions, both nominal and verbal items occur, and among the latter there are verbs supplied with target morphemes for infinitive, gerund, and present:

- (2) ha preso questo: portafoglio
'he took his wallet'

allora era si chiama Giorgio no?
then was REFL calls Giorgio no?
'he was called Giorgio' (Marcos)

The lexical component also comprises complex constructions with target-like periphrastic forms for progressive and perfective past. The wide range of different forms found in copula-auxiliary constructions appears to be an extension of target constructions: (a) the stative predicate and the equational construction where the copula is used with adjectives and nouns as in *to be pretty* and *Rome is the capital of Italy*; (b) the perfective past construction with unaccusative intransitive verbs such as *to come*. In all of these target constructions the copula is the sole carrier of finiteness; this is in particular apparent in equational constructions, where the copula is the lexical expression of a logical abstract relation between nominal items in Benveniste's terms. In

fact, both target constructions arise in the learners' Italian prior to auxiliary-copula constructions. The detailed study of one learner with L1 Tigrinya has shown a widespread use of the auxiliary-copula construction employing the imperfective past, which is the first form inflected for tense that appears in the learner varieties of Italian long before lexical verbs are fully inflected for the imperfective tense.

- (3) ieri anche + era congressa così
 yesterday also was convention so
 'Yesterday there was a convention too' (Marcos)

A clue to the learner's choice of the copula as substitute (and provisional) carrier of finiteness might be seen in the non target-like postcopula position of negation found as a sporadic error in some learners. This error is exceptional in the acquisition pattern of Italian pre-verbal (and precopula) negation and results in patterns as (Noun-)Copula-NEG-X, where X may be any item.

- (4) siamo on ha fatto
 we-are not has done
 'we didn't do (our show)' (Marcos)

This pattern, though inconsistent with the input of native Italian and with the regular behaviour of the learners, is consistent with the marking of the scope of the negator in the surface order of the utterance. Finiteness does not belong to the scope of negation and the copula as its carrier is therefore positioned to the left of the negator.

During his stay at the Institute, Perdue continued his work on the structure and functioning of early (1st and 2nd language) learner varieties (see also Chapter 8). He found confirmation in both early child and adult productions of the so-called "conceptual ordering stage", (see Annual Report 2002:135). An important claim of the conceptual ordering stage is that the formal ordering of constituents is determined by principles of information structuring: utterances consist of three positions, each with a particular function. Thus, the topic occurs in initial position. It functions as an anchoring element, i.e., it establishes external reference to the outside world or to the previous utterance. The predicate occurs in final position. It refers to a particular state of affairs which holds for the topic element. The relation between the predicate and the topic element is validated by a linking element. This linking element occurs between the topic and the predicate, and specifies the illocutionary force of the utterance.

Perdue placed these, and other previous results (e.g., Klein & Perdue 1997), in the context of a critical assessment of the use of the notion "simple codes" or "protolanguage" (Bickerton 1990) in recent speculations on the development of

human language that appeal to comparative data: what can observable ontogenetic processes tell us about phylogeny? This question is the source of Comrie's idea of "creating language anew", which Comrie develops by extrapolating from contemporary evidence back to language genesis: "The early humans who had developed the ability to acquire human language could in principle have taken off from whatever protolanguage they already knew and expanded it..." (Comrie 2000:1000). Perdue's criticism centers on the lack, in such speculations, of detailed analysis of the structure and functioning of this 'protolanguage'. In relation to the above results, for example, it appears that both children and adults create a relatively "simple code" whose functioning is distinct from that of the target language, which allows them to produce semantically finite utterances, i.e., which allows them, via the linking element, to validate the descriptive content of an utterance in respect to its topic component, *before* the stage where the grammatical categories traditionally associated with finiteness – person and tense – emerge. By extrapolation, it may be that the illocutionary force of an utterance was already marked at some 'protolanguage' stage of language genesis.

Schmiedtová finished the research for her dissertation on the acquisition of temporal expressions of simultaneity by English and German learners of L2 Czech. Various differences were found with respect to: (i) how learners encode simultaneity in their respective source (SL) and target (TL) 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 either aspectual devices alone (*opposition* of perfective/imperfective (5), or *juxtaposition* of two imperfectives (6)), or in *combination* with temporal adverbials (7).

(5) Aspectual opposition

Tak on to *slízává* (imperfective), někdo otevře (perfective) dveře
'So he is licking it off, somebody opens the door'

(6) Aspectual juxtaposition

And there *is* a man *sitting* on a couch and there *are* men *repairing* the couch

(7) Aspectual opposition plus adverbial

He goes to lick off the ketchup [...], and *while* he *is doing* this, his brother *walks into* the room

German native speakers exclusively use temporal adverbials for encoding simultaneity. This seems to have consequences for the acquisition of L2 Czech. From early on, English learners use aspectual devices on their own significantly

more often than German learners. German learners, on the other hand, cling to the familiar adverbial way and only exploit aspectual means at a more advanced level of proficiency. However, when reaching this proficiency level, German learners' performance is more target-like than that of English learners who overuse aspectual means. Although the resemblance between SL and TL initially gives rise to a more target-like performance, it turns out to be misleading during later stages of acquisition.

(ii) Striking differences were also noticed with respect to the way English and German learners acquire the Czech aspectual system and its basic opposition between perfectivity (encoded either by suffixation (-*nou*) or by prefixation) and imperfectivity (suffix -*va*). Native speakers of Czech use both forms equally often. German learners use significantly more perfective forms (marked via prefixation), while English learners show a rather balanced and target-like employment of perfective and imperfective forms. This sensitivity can again be motivated by the structure of the corresponding SL: English, as opposed to German, has a grammatical form for the expression of imperfective aspect.

10.2 The age factor in L2 acquisition

In cooperation with Haberzettl (U. Bremen), Dimroth compared the emergence of verbal paradigms in L2 German to the acquisition of verbal inflection in L1 German as documented in the literature (Bittner 2000, 2003; Klampfer 2003). Longitudinal production data of three 6- to 8-year-old untutored Russian learners of German (based on the Wegener corpus and the corpus collected in the DFG project DaZ-AF conducted by Dimroth and Stephany (U. Köln), (see Annual Report 2001) reveal that these L2 learners proceed faster than monolingual children acquiring German as their mother tongue. A productive and error-free marking of subject-verb agreement was achieved very early (see Annual Report 2002:147), despite the fact that the observed L2 learners continued to speak their L1 Russian at home, and thus had less German input than the monolingual children.

In particular it was found that older children needed much less time for the first so called miniparadigms (Bittner et al. 2003) to show up in their production. Miniparadigms are defined as spontaneously produced sets of at least three distinct inflectional forms of the same lemma which appear in different contexts (attested within one month). As shown in table 10.1 (grey cells) for the 8 year old L2 learner Nastja, there are already a couple of miniparadigms emerging during the first weeks of exposure to German. Stem alternations, which the learner also produces correctly, are disregarded in the table.

	1	2	3	4	5	6	7	8	9	10
geb- 'give'			-0				-0 -t	-e		-0 -e -t
geh- 'go'	-e		-en	-e -t	-st	-e	-t -en	-e	-e -t -en	-t
hab- 'have'	-t	-e		-e -st -t	-e -st -en	-e -t -en	-e -st -t -en	-e -st -t -en	-e -t -en	-e -st -en
mach- 'do'	-e		-t	-e -st		-t	-e -st	-0 -e -st -t	-e -t	-e -en
nehm- 'take'								-0	-e -en	-t
schreib- 'write'						-e		-e -st -t -en	-t	-en
spiel- 'play'	-e	-e -t				-e		-st -t	-e	

Table 10.1: Miniparadigms attested in the first 10 weekly recordings of free production data in Nastja

As documented in recent studies on the L1 acquisition of German verbal morphology (Bittner 2000, 2003; Klampfer 2003), the emergence of miniparadigms is a much later achievement in monolingual children. Before reaching this stage, early L1 learners have been shown to produce singular verb forms in rote-learned phrases to which no kind of morphological knowledge can be attributed. A critical mass of verb lemmas has to be stored and recognised as such. This stage is prepared by an increase of morphological diversity of the

(still rote-learned) verbs and starts with first target-like differentiations in the syntactic use of inflected forms which are then extended to new entries in the verb lexicon. Only then, when syntactic operations begin to take place, can morphological categorisation and the recognition of systematic relations between individual verb forms become possible and the first miniparadigms emerge.

There is good evidence that beginning child L2 learners, in principle, follow a similar input-driven and pattern-oriented strategy, i.e., they collect a stock of linguistic material and to use it more or less unaltered (Tomasello's usage-based theory of language acquisition, see Annual Report 2002:147). But the sample size needed for the abstraction of rules is apparently smaller and thus reached faster by the L2 learners. Older children have an advantage in cognitive maturity, i.e., a better understanding of complex conceptual domains encoded in language (like, for instance, time). Moreover, these older children are experienced language learners who know to pay attention to formal contrasts, knowing that these might be functional.

Pagonis (U. Heidelberg and MPI) started his dissertation project on the age-factor in untutored second language acquisition of German. The basic assumption to be investigated is that late learners' apparent inability to reach a native-like level in SLA is due to a noncontinuous age-related decrease of their propensity to socially assimilate to the foreign society. Conclusively, the hypothesis assumes that learners who start to acquire the L2 after the onset of puberty are still capable of attaining native-like proficiency in the L2 from a cognitive point of view, but unconsciously cease to aim at becoming undistinguishable from their environment by reaching this very particular variety. Instead, they learn the L2 with the objective of "merely" being able to communicate.

In order to explore this hypothesis, production data from a longitudinal case study (DFG project DaZ-AF, Dimroth & Stephany) on the acquisition of L2 German by two Russian sisters (aged 8 and 14) will be examined. Starting point for the investigation is Dimroth's study of the two subjects' acquisition of selected areas of target language morpho-syntax. By comparing the two learners' use of verbal morphological forms, Dimroth (see Annual Report 2002:148) shows that developmental similarities (i.e., the older learner uses forms as target-like as the younger) concern forms which are highly relevant for communication, while differences (i.e., the older subject doesn't perform as target-like as her younger sister) appear where forms of less communicative value are concerned.

It is the aim of this dissertation-project to examine these preliminary results. The study of target-language properties which differ with regard to their communicative relevance might reveal that those morphological forms which possess highly relevant communicative functions are acquired by both learners equally well, whereas morphological forms which are of little importance for daily communicative needs are only acquired by the younger learner while being systematically ignored by the older.

11 OTHER RESEARCH

Introduction

- 11.1 Comprehension in discourse
- 11.2 Paradigmatic structures in morphological processing
- 11.3 Theory-independent metrics

11.1 Comprehension in discourse

11.1.1 Topic-hood and parsing ambiguous relative clauses.

It has been established for several languages that sentences with subject relative clauses (SR) such as (1) are preferred over sentences with object relative clauses (OR) such as (2): Reading times at the disambiguating auxiliary were longer in the OR clause than in the SR clause.

- (1) de professor, die de studenten gezien heeft, ... [SR]
'the professor, who the students seen has'
- (2) de professor, die de studenten gezien hebben, ... [OR]
'the professor, who the students seen have'

In earlier research (see Annual Report 2000), however, Vonk and Mak (U. Nijmegen) demonstrated that animacy and topic-hood affect the initial parse of the relative clause. For instance, when the NP in the relative clause is a case-ambiguous pronoun, such as *jullie* ('you' -pl) (indicating topicworthiness), readers interpret it initially as the subject of the relative clause: a shorter reading time of the auxiliary was obtained in the OR clause than in the SR clause.

Vonk and Mak further explored the effect of topic-hood in an experiment in which they manipulated the discourse context in which the relative clauses were embedded. Relative clauses with two full NPs, such as in (1) and (2), were placed in the context of a short story. After contexts in which none of the NPs was a discourse topic longer reading times were obtained at the relative clause-final verb in OR clauses than in SR clauses, replicating the results found in isolated sentences. When the NP in the relative clause was the discourse topic in the preceding context, however, no significant difference in reading times between SR and OR clauses was obtained at the relative clause-final verb. The results demonstrate that the syntactic processing of temporarily ambiguous relative clauses depends on topic-hood at the discourse level.

11.1.2 Prosody and parsing ambiguous NP and S conjunctions

Together with Kerkhofs and Schriefers (both U. Nijmegen), Vonk examined the resolution of syntactically ambiguous sentences in context, focusing on prosodic information and contextually induced syntactic expectancies. The syntactic ambiguity consisted of a conjoined-NP versus an S-conjunction reading, such as in sentence fragment (3), which can either continue as in (4) (NP coordination), or as in (5) (S coordination).

- (3) The model kissed the designer and the photographer ...
- (4) The model kissed the designer and the photographer at the party.
- (5) The model kissed the designer and the photographer opened a bottle of wine.

In spoken language, the difference between an NP coordination as in (4) and an S coordination as in (5) can be cued by the presence (in 5) of a prosodic break before "and", consisting of a pitch rise and lengthening of the final syllable of the noun preceding "and", and a pause following the rise, while no such prosodic break occurs in (4).

Target sentences with and without a prosodic break were embedded in contexts designed to induce a syntactic expectancy: in a biasing context, biasing towards an S-coordination resolution of the ambiguous fragment, or in a neutral context, biasing towards an NP-coordination resolution (cf. Annual Report 2000). The stimuli were presented auditory. Event-related potentials (ERPs) were recorded from 30 subjects.

The prosodic break elicited a so called Closure Positive Shift (CPS; a positive deflection in the ERP signal; cf. Steinhauer et al. 2002), comparing the ERPs time-locked to the offset of the noun before "and" for the target sentences with and without prosodic break in the neutral context, and comparing these ERPs for the target sentences with a prosodic break in the biasing context and the target sentences without a prosodic break in the neutral context. The question is whether the CPS just reflects the brain's reaction to the acoustic features of the break or whether it reflects the immediate matching of prosodic information against a syntactic structure; that is, whether the CPSs to one and the same prosodic break are modulated by the syntactic expectancy. The CPS was reduced in amplitude when, due to the context, a syntactic break was expected at the position of the prosodic break in comparison to when the syntactic break was not expected. The results show that the brain immediately evaluates prosodic information against syntactic expectations.

11.1.3 A model of knowledge-based inferences

Vonk, together with Frank and Noordman (both Tilburg U.), and Koppen (U. Nijmegen) finished a project in which a computational model was 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. In the Distributed Situation Space (DSS) model, a situation is distributively represented as a point in a high-dimensional situation space. Comprehending a story is the process in which the reader constructs the narrative situations from the situation-space vectors based on the sentences in

the text and estimates the likelihood of propositions that are not given in the text. The latter are inferences.

The model was further extended to simulate knowledge-based pronoun resolution. In the pronoun resolution model, a statement containing an ambiguous pronoun is turned into a proposition when a discourse entity is chosen to serve as antecedent. The ambiguous statement, just like normal propositions, can be represented by a vector in situation space. This vector is a combination of all vectors representing a possible outcome of the pronoun resolution process. This combination is modified by focusing, such that the vector for the ambiguous statement becomes closer to the vector resulting from choosing the most focused entity as the pronoun's referent. A decision among possible referents is forced by making the vector 'fall' towards the situation space regions corresponding to disambiguated statements. This process is affected by the DSS model's inference process, thereby implementing the effect of context information on pronoun resolution. The pronoun resolution model simulates how the initial interpretation of a pronoun depends on focus, but can be overridden by context information that is inconsistent with the focus. Moreover, it can account for empirical data regarding reading times and error rates, and explains how these are affected by focusing, context informativeness, and depth-of-processing.

As another extension to the DSS model, an attempt was made to supply it with a textbase-level representation by training a recurrent neural network to transform sentences into the DSS vectors representing the situations described by the sentences. For this task, a micro language was developed to describe story situations. The network learned reasonably well to process these sentences. The intermediate representation that resulted was shown to combine surface text, propositional, and situational aspects of discourse in a single level of representation.

11.2 Paradigmatic structures in morphological processing

In collaboration with Bertram (U. Turku, Finland), Deutsch and Frost (U. Jerusalem, Israel), Dijkstra (NICI, Nijmegen), and Schreuder (IWTS, Nijmegen), Moscoso del Prado and Baayen studied the morphological family size effect in Hebrew, Dutch, Finnish, and Dutch-English bilinguals. Experiments with translation equivalents in Hebrew, Finnish, and Dutch revealed that response latencies in visual lexical decision in the one language can be predicted from the word frequency count of its translation equivalent in one of the other languages. In addition, the morphological family size was shown to be predictive across Hebrew and Dutch, as well as Finnish and Dutch, after first partialling out

effects of word frequency and word length. Possibly, the absence of cross-language predictivity for family size across Finnish and Hebrew is due to the typological distance between these languages. In Finnish, morphological families may contain up to 5000 members, in Hebrew, the maximum family size is 25. Dutch, with a maximum of 550 family members, occupies an intermediate position between the extremes of Finnish and Hebrew. This may help explain why crosslinguistic predictivity is possible for the comparisons involving Dutch. Considered jointly, the cross-language predictivity of frequency and family size suggests there is a substantial semantic component, not only to the family size effect, but also to the word frequency effect.

The hypothesis that the family size effect is semantic in nature received further support from Hebrew. In this language, homonymic roots such as RGL, which give rise to words in unrelated semantic fields (compare ReGeL, 'foot', with meRaGGeL, 'spy') revealed both a facilitatory family size effect (for the family members in the same semantic domain) and an inhibitory family size effect (for family members in other semantic domains). Similar opposite family size effects were observed for interlingual homographs (e.g., "room", English 'room', Dutch 'cream') in the Dutch-English bilingual lexicon. The change in the direction of the effect when going from semantically related to semantically unrelated family members shows unambiguously that the family size effect taps into the paradigmatic organization of morphologically related words in the central mental lexicon.

In collaboration with Kostic (U. Belgrade, Serbia), Moscoso del Prado and Baayen also studied the family size effect from an information-theoretical perspective. They developed a probabilistic measure of the informational complexity of a word, which they named its information residual. It captures the combined influences of the amount of information carried by the target word and the amount of information carried by its morphological paradigms (the summed entropies of the inflectional and derivational paradigms of the target word). This measure outperforms the combined traditional token-based and type-based counts in predicting response latencies in visual lexical decision.

In a complementary approach, Moscoso del Prado developed an artificial neural network model for visual lexical decision. The input vectors of this model (representing orthographic form) and the output vectors (representing word meaning) were obtained by training separate network models for form (based on 150,000 word forms from the CELEX lexical database) and meaning (based on a subcorpus of 20 million words from the British National Corpus). The cosine distance between the semantic vector activated by the input and the true

semantic vector associated with that input turned out to correlate with processing difficulty as measured by visual lexical decision latencies. The model was evaluated on some 2000 monomorphemic and monosyllabic nouns and verbs taken from the database of Balota, Cortese, and Pilotti (1999). A comparison of the model's cosine distances and the actual visual lexical decision response latencies reported by Balota et al. revealed very similar effects of word frequency, inflectional entropy, derivational entropy, neighborhood density, and age of acquisition. Interestingly, these results were obtained without using any hand-crafted intermediate representations. Note, furthermore, that the model was trained on a realistic data set that is an order of magnitude larger than the datasets reported for connectionist models in the literature. Although the model does not directly model information processing in biological neurons, we believe it provides a useful first information-theoretical approximation of the interactions between distributed patterns of activation representing the meanings and forms of words in the brain. The abovementioned entropy measures for inflectional and derivational paradigmatic complexity can be viewed as the symbolic counterpart (calculated over parse trees) of the processing complexity of paradigmatic structure captured implicitly by the network model.

Together with Moscoso del Prado, Baayen studied the semantic differences between regular and irregular verbs in English, German, and Dutch. Ramscar (2002) showed that the semantic context in which a nonse verb has to be inflected may favor or disfavor the use of a regular or irregular past tense form. The question that we addressed is whether this context effect is due only to local semantic attraction, or that there might also be subtle distributional differences between regular and irregular verbs at the semantic level. Data mining resources such as WordNet, CELEX, the Florida association norms, and the database of Balota, Cortese, and Pilotti (1999) revealed that irregular verbs tend to have a higher semantic density. They tend to have more meanings and to have more associates. In German and Dutch, irregulars also have a preference for the auxiliary *SEIN*/*ZIJN*. Interestingly, visual lexical decision latencies to irregulars tend to be shorter than the response latencies to regular verbs, when matched for frequency, which shows that the observed subtle differences in semantic density have detectable consequences for lexical processing.

11.3 Theory-independent metrics

F. Hellwig in collaboration with De Groot (U. Amsterdam) and Borgwaldt (U. Sydney) developed theory-independent metrics that allow ranking of languages in terms of their bidirectional orthographic transparency. Applying these algorithms to large-scale corpora of 6 languages (3 Germanic, 2 Romance, and 1 Finno-ugric) resulted in cross-language comparisons of their sound-spelling ambiguities, expressed as entropy values for word onsets. They explored whether onset ambiguities expressed as entropy values affected performance in several reading tasks and whether the influences were language-specific or generalized across languages. They found significant correlations between entropy values and naming latencies across languages. This finding suggests that deviations from unambiguous letter-phoneme mappings in either direction influence lexical processing, resulting in positional regularity and feedback effects. The result provides support for reading models with serial letter-based components.

12 TECHNICAL GROUP

Introduction

- 12.1 Overview of externally funded projects
- 12.2 Computer systems and networks
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- 12.7 Electronics and audio/video facilities
- 12.8 Other activities of the Technical Group

This past year the Technical Group (TG) continued to receive substantial external funding, enabling them to increase their activities in archive creation, management and exploration as well as to achieve cross-discipline metadata interoperability. In addition, the TG initiated and participated in several international activities.

Work in the TG is carried out in 7 major groups: server systems, desktop systems, electronic lab, experiments, information and database systems, corpus software development, and corpus management. The first five are intended to provide the standard support required by experimentally oriented researchers. The last two groups are specifically designed to meet the needs of MPI researchers. In 2003 many milestones were achieved in the area of standard services. The corpus group shifted its focus, concentrating more on the exploitation of corpora rather than the creation and structuring of new corpora.

The tools the TG creates are available at the web-site www.mpi.nl/tools, and the corpora they maintain can be accessed via www.mpi.nl/corpora. All tools are now available under the open source license model.

12.1 Overview of externally funded projects

A number of externally funded projects were either continued or initiated in 2003. The Corpus Exploitation Tool (COREX) project continued with the goal of completing the final version of the Dutch Spoken Corpus (CGN) together with its exploitation software in January of 2004. The European Cultural Heritage Online (ECHO) project was started in late 2002, and the Integrated European Resource Area (INTERA) project began in January 2003. Further, the Documentation of Endangered Languages (DOBES) program was continued throughout 2003.

In the COREX project a number of additional functions were added to the exploitation tool. The TIGER treebank search tool was integrated in the COREX tool and a lexicon component was added. This new feature allows users to execute searches using the CGN lexicon. In addition, prosodic annotations can now be visualized and searched. These preparations are aimed at integrating all of the data in the Dutch Spoken Corpus in order to generate the final version of the whole project. An offer was made to the Taal Unie and the Institute for Lexicology to support CGN for another year and to develop software such that the corpus can be extended and offered to users via modern web-technology.

The ECHO project led to intensive interactions between the MPI and different partners. The ELAN software was developed in dimensions that were particularly important for the Sign Language subgroup within ECHO. In close collaboration

with Lund University, training courses were provided to motivate and help other language resource providers make their resources visible to others by creating IMDI (ISLE Metadata Initiative Set)-type metadata. Further, the group developed a plan for integrating the metadata of all 5 disciplines involved in ECHO (linguistics, history of arts, history of science, ethnology, philosophy) into a joint metadata domain. A user interface (http://corpus1.mpi.nl/ds/dora_demo3/index.jsp), including all server-side programs, was developed to carry out metadata harvesting and transformation as well as to execute fast searches on the joint data. Semantic mappings between the metadata elements of the different domains and subdomains were defined and will be used during searching. The mapping extends to widely used thesauri such as IconClass and AAT derivatives. Anticipating that many copies of humanities resources will be created, a unique identifier resolving mechanism was installed that can be used by all partners. This work is described in various documents that can be found at www.mpi.nl/ECHO.

In the INTERA project the TG is responsible for generating an IMDI metadata domain that will combine several European language resource centers. In this realm the IMDI set was extended to cover written resources and lexicons. The metadata tools (editor, browser) were improved and extended (tree-builder) and training courses were given. Further, in close collaboration with DFKI, a first version of a protocol was implemented that links the resource and the tool domain. Metadata profile matching is used to determine suitable tools when resources have been selected.

The DOBES program is currently supporting 21 documentation teams, resulting in 630 digital master files that must be further analyzed and annotated by the teams. After the annual training course was given, some teams decided to do remote video digitization. Unfortunately, this decentralized workflow scheme tends to produce more erroneous data. However, remote digitization is very useful for the teams because they can start analyzing and annotating immediately in the field. Some converters were programmed to bring data (annotations, lexicons, metadata) into standard XML format. For an exhibition of the VolkswagenStiftung, a demonstration setup was prepared which was recently transformed to become the new DOBES web-site. Great care was taken to make the DOBES collection accessible to normal browsers. Now interested users can browse the metadata domain with normal web-browsers. In addition, we have begun investigating the possibility that users will be able to access the resources themselves via HTML output and media streaming. Currently, an access rights management system is being prepared that allows us to define access rights to managers for subcorpora in addition to defining groups and the

access rights associated with them. This system makes use of the IMDI metadata hierarchy, i.e., rights are given for resources to be found under a selected node in the metadata tree. Therefore it is possible to specify access rights on a whole range of resources with one command. The system should be ready by early 2004, at which point all DOBES team leaders will be able to specify which resources may be accessed by different groups of users. This web-based system is of crucial importance since it is impossible for the MPI corpus management to handle all requests for accessing resources. Further, the development of the ELAN tool continued in order to better meet the needs of field linguists.

It should be mentioned here that the TG is one of the initiators of the new DELAMAN initiative (www.delaman.org) that brings together major archives of endangered languages and music material. One of the tasks is to develop a joint access management system and to establish the basics for sharing sensitive data amongst the archives to support long-term data safeguarding.

The TG continued to take an active role in the ISO TC37/SC4 (Technical Committee/Subcommittee) that deals with Standards for Terminology and Management of Language Resources. A lexicon workshop was organized to better understand the requirements. We participated in discussions about annotation structures, and the first version of a document describing requirements for future metadata scenarios was completed.

12.2 Computer systems and networks

In the computer systems and networks groups, a great deal of time and energy was invested in creating redundant copies of very important data, such as that maintained by the DOBES program. The Institute's tape library houses two copies of all corpus data. Qualified data is also copied to a PC that is located outside of the building, but under the TG's control via the Rsync mechanism of the GWDG computer center in Göttingen. Another copy will be sent soon to the RZG computer center in Munich, once the installation of the Andrew File System (AFS) client on our PCs is complete. Since the computer centers do not have the technology to guarantee long-term data maintenance, negotiations have been initiated with the leaders of the Max-Planck-Society to develop more reliable long-term data maintenance procedures.

The Institute's storage capacity was extended to 25 TeraByte, anticipating that more and more researchers will step over to MPEG2 as archive format because it gives about 4 to 5 times more data than MPEG1. The cache disk space was extended such that the presentation formats (wav, MP3, MPEG1/4) of all

resources can be held on disk. In doing so the average access delays could be reduced dramatically. A new backup system was tested and installed to reduce the personal effort involved considerably.

Two new services have been very well received by the Institutes' researchers. First, a new web-mail interface allows users to do email handling via the web. Second, a Virtual Private Network (VPN) was setup such that users who have a VPN client on their notebooks can now access all MPI resources from remote places in a secure way.

Almost all Windows-based PCs of the Institute were moved to Win2000 and several new MSI packages were created for easy software distribution. More than 70 new PCs and Notebooks were setup in 2003, some of them replacing old UNIX workstations. On the server side, a smooth trend towards LINUX systems was performed. Some services such as backup and web-services have been moved to LINUX machines.

The number of Linux desktop systems was increased, since researchers increasingly want to carry out UNIX-based operations. The move to MAC OSX can be seen as a big step forward in system management since the frequency of user problems decreased considerably.

12.3 Information systems

A number of information services have been added, mostly smaller database solutions combined with web-interfaces for research purposes. The digitization team, which is handling all requests for audio and video digitization (most often for the DOBES program), has developed a database that describes the workflow in such detail that corpus management and the researchers can have more control over their resources. Another larger investment was the creation of a Speech Error Database for the comprehension group that contains various well-known existing error databases such as the UCLA Speech Error Corpus (UCLASEC). This data is also accessible via the web-site.

A new design for the Institute's main web-site was created and is now in the process of being developed.

12.4 Corpus management

The multimedia corpus at the MPI developed very rapidly during the past 4 years. It now contains more than 20,000 sessions and digital master files (DMF), and every year our researchers return with many more tapes to be digitized or captioned. As a consequence of collection's rapid growth, the TG has

discovered that an increasing number of errors have slipped into the multimedia corpus. Several scripts were developed that enabled us to control the status of links, unlinked files, erroneous metadata and other phenomena and to correct obvious errors and inconsistencies. Most of this correction work could be done successfully until the end of the year.

Rather problematic is still the situation with some old MediaTagger files. Uncontrolled copying actions on non-Mac systems resulted in the loss of the resource forks of many of these files. Often resource forks contain rather trivial data such as a custom icon or the type and creator of the file, but unfortunately in the case of MediaTagger files, they also contain the annotations and the media links. Most of these files could be retrieved from backups, but some seem to be definitively lost, which means that valuable analysis work disappeared. Another problem is a compatibility problem between different QuickTime (QT) versions. MediaTagger files created with QT 4 can often not be opened using QT 6 and vice versa. Writing a program to convert files from the old to the new QuickTime version appears to be a non-trivial issue. These examples illustrate the problems that can occur with archives when the users and managers are not aware of the differences between old and new technology.

We have realized that only a small portion of the taped sessions get analyzed within a short time frame. Therefore, the workflow schema had to be adapted. DMFs and computerized copies of tapes have to be described by metadata too, and are now accepted as archive material as well.

Currently, the members of the TG are busy analyzing all the scripts and data structures that are created for the management of large multimedia collections. The goal is to implement a workflow schema that is widely supported by automatic procedures to simplify corpus management and to allow easy checks. The intention is that these procedures will be used by both researchers and their student assistants, allowing them to ingest their resources and their corresponding descriptions. In 2004, we expect to have completed such a web-based ingest system that relies on distributed IMDI metadata descriptions as the kernel. In addition the TG will focus on improving the content of all metadata descriptions in 2004, i.e., the attention will shift from structural to content aspects of the descriptions.

12.5 Linguistic applications

In this area most development work is carried out within 5 major areas: (1) IMDI infrastructure, (2) HTML corpus access, (3) access rights management (4) ELAN multimedia tool (5) conversions.

12.5.1 IMDI infrastructure

The new IMDI set version 3.02 was finished and the schema was made public. The controlled vocabularies are also available as open schemas and the editor and browser tools have been adapted to the new version. Also a conversion script from version 2.5 to the new version has been developed and tested; the conversion of all metadata descriptions will take place in January 2004. In addition, the inherent flexibility of the IMDI set was used to create special profiles for certain projects or subgroups. For the Sign Language community a profile was created that considers their specific requirements. Also, for the Dutch Spoken Corpus, a profile was created to take care of the TEI compliant elements that were used. Both the editor and browser are now mature tools insofar as they have been in operation for several years and have been optimized to fit the user needs. They support special profiles and the editor allows the user to save and therefore re-use parts of the metadata descriptions. These tools will be further developed for many years and are available under open source license such that everyone interested in IMDI technology can re-use the code.

A Tree building tool was developed that allows the user to easily create his own virtual IMDI domain by graphically selecting existing corpus nodes and combining them in new ways. In doing so a private working domain can be created.

A script was developed that allows users to easily create IMDI corpus structures. Users can describe their structure with the help of a spreadsheet (Excel) which allows simple operations. Since corpus structure definition does not include controlled vocabularies, the use of unconstrained input methods does not form a problem. The use of Excel files for the creation of metadata descriptions, however, turned out to be very problematic since many errors were introduced that later had to be corrected.

Within the INTERA and ECHO projects, further language resources from institutions all over Europe will be described with IMDI metadata. The technology to integrate all this data to one searchable and browsable domain is ready. In 2004 the IMDI domain will be extended considerably.

12.5.2 HTML corpus access

Experience has taught us that expecting users to download and install an application on their own can be problematic. Too many unexpected situations can occur. Therefore, the TG decided that it should be possible to browse and search in the IMDI metadata domain with simple methods known from the normal web. XSLT-based programs generate html pages from the XML-based

IMDI files on the fly which makes it possible to use a normal web-browser such as Internet Explorer for browsing. The position in the archive tree is indicated by a path. In addition, a Google-like search field is offered. The values of all metadata elements including those that contain prose text such as descriptions are gathered and integrated into a large full-text type index. This allows unstructured search on structured data. A larger number of wrong hits can be expected, however, the user does not have to understand the semantics of the IMDI elements and the way they are used by the data providers. The TG sees this as an alternative option for searching and will integrate such mechanisms in all tools. However, it has to be mentioned that professional operation can only be expected when using the IMDI tools. The HTML-based corpus access can be found under www.mpi.nl/corpora.

The TG also tested out methods to access the resources themselves (media, annotations) by HTML-based methods. Two methods have been developed. Annotations created for audio/video recordings with the help of ELAN can be transformed to SMIL files. These can be played by normal browsers since SMIL is a standard accepted by W3C which can present movies with subtitles. Alternatively, ELAN annotations can be transformed with the help of XSLT scripts to html pages where all annotations appear as clickable instances. Clicking on such an annotation will start streaming of the corresponding media fragment. Streaming will be done using the Darwin media streamer which is compliant with the Quicktime client.

12.5.3 Access rights management

Managing access rights is an increasing problem not only for the MPI corpus, but also for the corpuses such as that gathered by the DOBES program. Until now corpus management sets the access rights by making use of SAMBA shares, however, this turned out to be very time consuming and does not offer any move towards web-based access which is especially relevant for the DOBES program. Using a quick HT-Access (associated with Apache Web-Server) based solution that allowed the team leaders in the DOBES program to access their data, a setup was designed that gives more flexibility. Access rights can be specified for all resources and resource types that can be found under a specific corpus node. Access rights managers can also delegate the management of subcorpora to others. There is no intention yet to add the possibility of "write access" since this will lead to inconsistencies in the corpus. However, in the future access rights need to be further extended. The web-based interface for defining access rights is ready and can be tested. Currently, the database and the script that converts the database entries into HT-Access entries are being implemented.

12.5.4 ELAN multimedia tool

A complete overhaul of the ELAN code was necessary to acquire an easily manageable code again. This is required for every complex piece of software. Based on this new code a number of important features have been introduced and were made available in ELAN version 2.0. ELAN now has the following major additional features: (1) a new much more flexible user interface, (2) improved methods to navigate in the media stream, (3) multi-language user interface now also supporting Dutch, (4) multiple synchronized video streams for comparative analysis, (5) loop viewing allowing users to repeatedly play the same fragment, (6) creation of SVG graphics to mark spaces in the video signal and their presentation synchronized with the video. In addition, it is no longer necessary to use identical names and locations for media and annotation files. The next ELAN version scheduled for April 2004 was prepared.

It will be extended in two major directions: (1) allowing 2D annotations over time and (2) allowing collaborative annotations across the Internet. The work with a lexicon feature will be started also, but will become ready later in 2004.

12.5.5 Conversions

Several conversions from old formats to XML had to be carried out again. The WORD annotation converter was extended slightly to also handle lexicons written in WORD. They are transformed into Shoebox or XML output.

12.6 Experimental facilities

The well-proven Nijmegen Experiment Setup (NESU) software package was extended with additional minor functionality driven by concrete experiment requests. In particular, we dealt with the increasing demands for presenting video animations in a controlled way. The new Windows-based version of the EyeLink eye tracking system was also integrated with the Windows version of NESU. Hardware devices such as the Minibox (a very simple box for time accurate measurements of reaction times) were also integrated with the Windows version of NESU. Some new experimental paradigms were implemented and are running successfully. A new revised babylab was set up supporting special attraction effects that required some new electronics. This project necessitated some small design extensions to the NESU software.

A new small NESU box was created for portable applications. It offers nearly the same functionality as the existing box, but its price is considerably smaller. It comes with its own microphone amplifier and VU meter so that users can carry out voice-controlled experiments as well.

Much time was devoted to replace almost all old PCs in the experimental rooms with new more powerful ones and to upgrade to Win2000 or WinXP. This was especially necessary for experiments where video animations are required as part of the paradigm.

12.7 Electronics and audio/video facilities

Preparing 29 expeditions within a short time frame proved to be quite a challenge this past year. Therefore, for the first time ever, the TG organized a meeting with all of the researchers returning from the field. One complaint was that preparing for the trips was very hectic. The researchers did not always have enough time to properly test their setups. Despite these difficulties, the equipment worked astonishingly well in the field. Continuing problems are reported with the use of re-chargeable batteries, although much care has been taken to keep them in good condition. The Lithium batteries generally work better than the former NiH and NiCad batteries (little memory effect, better energy/weight, no self-discharging), but they show a clear effect on the number of re-charging cycles. After a few hundred re-charging cycles the energy they can store decreases significantly. Even worse, the measurement circuits don't show the correct actual energy anymore which is misleading the user. We can offer no better solution than to take reserve batteries to the field, reduce the number of re-charging cycles, and buy new batteries regularly. Some problems were indicated when using solar packs, but here the problems were mostly due to handling difficulties.

We have decided to have more training courses on equipment use and to better prepare fieldtrips. A web-based database is in preparation which allows researchers to plan their trip, to choose their own early date of equipment delivery, to enter the major type of equipment, and to gather field reports afterwards. Given the great number of fieldtrips that take place per year, only such an open information system will guarantee the planning security and exchange of useful information.

The state of the audio/video archive was improved in so far that users can now choose to enter their tapes into an archive with strict input/output rules. Each transaction will be documented and has to be signed by users.

New flashcard recorders were tested and are seen as successors of the DAT recorders. The first ones tested demonstrated the great potential of these recorders since there are no moving devices included anymore. However, we are waiting on the second versions since the first ones had some design drawbacks such as missing connectors. MiniDisc recorders are very useful in the

field, but it is agreed that compressed recordings should only be made in circumstance where high quality recordings are not possible.

12.8 Other activities of the Technical Group

Wittenburg continued to be a member of the Central Computer Committee of the Max-Planck-Gesellschaft. In this function support was provided for several activities important for the society as a whole and advice was given to a number of other Max Planck Institutes.

Collaborations

COREX Project *Corpus Exploitation Tools*, NWO funded Corpus Spoken Dutch Project (www.lands.let.kun.nl/cgn/ehome.htm).

DOBES Project *Dokumentation bedrohter Sprachen* Tools and Infrastructure for the Documentation of Endangered Languages, funded by VolkswagenStiftung, U. Kansas, U. Kiel, Free U. Berlin, U. Bochum, U. Victoria, U. Bonn, Yale U., International Cognitive Linguistics Association (ILCA), U. Buenos Aires, U. Frankfurt, Museo do Indio Brazil, U. Colorado, MPI Leipzig, U. Heidelberg, (www.mpi.nl/DOBES).

INTERA Project *Integrated European (Language) Resource Area*, EC funded German Research Center for Artificial Intelligence (DFKI) Saarbrücken, Laboratoire Lorrain de Recherche en Informatique et ses Applications (LORIA) Nancy, European Language Resources Association (ELRA) Paris, Institute for Language and Speech Processing (ILSP) Athens, Istituto di Linguistica Computazionale (ILC CNR) Pisa (just started).

ECHO Project *European Cultural Heritage Online*, EC funded MPI Berlin, Bibliotheca Hertziana Rom, Ecole des Hautes Etudes en Sciences Sociales (EHESS) Paris, U. Athens, Institute and Museum of the History of Science (IMSS) Firenze, U. Bern, U. Nijmegen, National Museum of Ethnology Leiden, U. London. (www.mpi.nl/echo).

13 OTHER ACTIVITIES

Introduction overview

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- 13.3 Nijmegen Lectures
- 13.4 Formal Colloquia
- 13.5 The F.C. Donders Lectures on Cognitive Neuroscience
- 13.6 Presentations at conferences, congresses and workshops
- 13.7 Colloquia presented
- 13.8 Teaching

13.1 Honors/Awards

JOANA CHOLIN obtained a talent grant from the Netherlands Organization for Scientific Research (NWO) for a postdoctoral stay in the USA.

PETER HAGOORT received the Dr. Hendrik Muller Prize of the Royal Netherlands Academy of Arts and Sciences (KNAW).

BIRGIT HELLWIG received a cum laude for her dissertation.

WILLEM LEVELT was awarded Doctorate honoris causa of the University of Antwerp.

STEPHEN LEVINSON was elected to the Academia Europaea.

FERMIN MOSCOSO DEL PRADO MARTIN received a cum laude for his dissertation.

ULRIKE NEDERSTIGT received a summa cum laude for her dissertation.

ARDI ROELOFS received a five-year VICI grant from the Netherlands Organization for Scientific Research (NWO) to establish a research group at the University of Nijmegen.

13.2 Workshops organized

Four Corners Workshop Series

Four workshops were held during 2003 on the nature of psycholinguistics; called the Four Corners Workshop Series, these meetings aimed to scrutinize the relationships that lie at the heart of our field. Psycholinguistics is necessarily interdisciplinary, and thus should continually encourage dialogue between its component parts. Each of the four workshops therefore focussed on one of the relationships crucial to the practice of psycholinguistics. The workshops were held over one and a half days (enabling ample discussion time) and each included six speakers - some from the MPI community, some from elsewhere in Europe, and some from outside Europe.

The first workshop, in February, concerned the relationship between model and experiment. Speakers were Ardi Roelofs (MPI), Dennis Norris (MRC Cognition and Brain Sciences Unit, Cambridge), Elke van de Meer (Humboldt U., Berlin), Matt Crocker (U. Saarland), Mark Pitt (Ohio State U.) and David Poeppel (U. Maryland and Wissenschaftskolleg Berlin).

The second, in April, dealt with the relationship between language production and language comprehension. Speakers were Karin Emmorey (Salk Institute, San Diego), Niels Schiller (MPI), James McQueen (MPI), Gabriella Vigliocco (U.

College London), Núria Sebastián-Gallés (U. Barcelona) and Fernanda Ferreira (Michigan State U.).

The third workshop took place in May and dealt with the relationship between psychology and linguistics. Presentations were given by Julie Boland (U. Michigan), Shari Speer (Ohio State U.), Paula Fikkert and Marco Haverkort (U. Nijmegen), Harald Baayen (U. Nijmegen/IWTS), Martin Pickering (U. Edinburgh) and Lera Boroditsky (MIT).

The fourth and final workshop, on the relationship between biology and behavior, was held in September. Speakers were Karin Stromswold (Rutgers U., New Jersey), Sharon Thompson-Schill (U. Pennsylvania), Tecumseh Fitch (U. St. Andrews), Gary Morgan (City U. London), Sophie Scott (U. College London) and Peter Hagoort (F.C. Donders Centre).

The collected presentations from the four workshops will appear in 2004 (if all goes to plan!) in a book to be published by Erlbaum, UK.

ECHO developers workshop

Peter Wittenburg, Hennie Brugman and Daan Broeder organized the ECHO developers workshop in Nijmegen in January. Participants from the partner institutions of the ECHO project determined the technology oriented work in the ECHO project. It focused on metadata infrastructure, multimedia tools and server infrastructures for the domain of cultural heritage (www.mpi.nl/echo).

ISO TC37/SC4 Workshop on Lexicon Schema, Registries and Repositories

Peter Wittenburg, in collaboration with Nicoletta Calzolari (ILC, Pisa) organized a workshop entitled "ISO TC37/SC4 Workshop on Lexicon Schema, Registries and Repositories" in Munic this past February. Fifteen distinguished researchers from field linguistics, language engineering and cultural heritage discussed lexicon structures. Strategies for developing an open and standardized domain of interoperable lexicons under the umbrella of the new ISO TC37/SC4 committee on terminology and management of language resources (www.mpi.nl/echo) were discussed.

Workshop on Projection in Interaction

Nick Enfield organized a workshop on Projection in Interaction (March 5-7). Presenters from MPI Nijmegen were Nick Enfield, Marianne Gullberg, Stephen Levinson, Jan-Peter de Ruiter and Mandana Seyfeddinipur. Other presenters were Makoto Hayashi (U. Illinois at Urbana-Champaign), Herbert Clark (Stanford U.), Gerda Lerner (U. California at Santa Barbara), Robert Barr (U. California at Riverside). Discussants were Sotaro Kita (MPI Nijmegen), and Nikolaus Himmelmann (Ruhr U. Bochum).

Workshop on the Linguistic Encoding of Three-Participant Events

A workshop on the Linguistic Encoding of Three-Participant Events: Crosslinguistic and Developmental Perspectives was organized by Penelope Brown, Bhuvana Narasimhan, and Sonja Eisenbeiß, and held 14-16 May 2003. The workshop brought together scholars who have done work relevant to three-participant events from the perspective of language typology, language acquisition, and psycholinguistics, to investigate three-place predicates from a crosslinguistic and developmental perspective. Participants included MPI members Melissa Bowerman, Penelope Brown, Nick Enfield, Friederike Lüpke, Sonja Eisenbeiß and Ayumi Matsuo; external presenters were Peter Austin (U. London), Heike Behrens (U. Groningen), Katherine Demuth (Brown U., Providence), Christian Dobel (U. Münster), Cynthia Fisher (U. Illinois, Urbana-Champaign), Catherine O'Connor (Boston U.), Keiko Murasugi (Nanzan U., Japan), and Clifton Pye (U. Kansas).

DOBES training workshop

Peter Wittenburg, Romuald Skiba and Hennie Brugman organized the DOBES training workshop in Nijmegen in May. Members of the MPI Technical Group gave various presentations on technical matters related to the documentation and archiving of endangered material languages.

ECHO IT days

Peter Wittenburg, in collaboration with Sven Strömquist and Marcus Uneson (both Lund U.) organized the ECHO IT days in Lund in September. The IT days had the goal to inform a broader group of partners within the ECHO project about technology directions and to discuss in depth the matters of metadata interoperability and annotation types in cultural heritage. A number of external experts gave key papers: Laurent Romary (LORIA, Nancy), Hans Uszkoreit (DFKI), Frank van Harmelen (Free U. Amsterdam), and Hans Anderson (Lund U.) (www.ling.lu.se/projects/echo/contributors/itdays).

9th Winter Congress of the Dutch Psychonomic Society

Niels Schiller co-organized the 9th winter congress of the Dutch Psychonomic Society (Nederlandse Vereniging voor Psychonomie; NVP), 19-20 December, Egmond aan Zee.

13.3 Nijmegen Lectures

This year's Nijmegen Lectures were given by Joan Bresnan (Stanford U.). The title of the series was "Categoricity and gradience in syntax". The series included three morning lectures: "Why do hard constraints mirror soft constraints?", "The dative alternation and the meaning of variation. Is variation

at the level of syntax determined by semantic differences?", and "Does morpho-syntactic variation occur in the grammar of the individual, or does it only reflect the pools of varying individuals from which corpus data are drawn?" The discussants of the afternoon seminars were Harald Baayen (U. Nijmegen/IWTS), Bernard Comrie (MPI for Evolutionary Anthropology), Gisbert Fanselow (U. Potsdam), Gerhard Jäger (U. Potsdam), and Henriëtte de Swart (Utrecht U.). 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 Marco Haverkort, Helen de Hoop, Kerstin Mauth, and Angela Terrill.

13.4 Formal Colloquia

The Formal Colloquium Series 2003 was organized by the Colloquium Committee (Sonja Eisenbeiß, Nick Enfield, and Ardi Roelofs).

January 21	TONY SANFORD, U. Glasgow: Modulation of attention during reading.
February 18	JOHN LUCY, U. Chicago and SUZANNE GASKINS, Northeastern U.: Comparative developmental methods in the study of language and thought.
March 11	DAVID GIL, Max Planck Institute for Evolutionary Anthropology, Leipzig: The Acquisition of syntactic categories in Jakarta Indonesian.
April 22	TECUMSEH FITCH, U. St. Andrews: The evolution of language.
May 27	HARALD CLAHSSEN, U. Essex, Colchester: Grammatical processing in second language learners.
June 17	GILLIAN BROWN, U. Cambridge: Deixis and English 'deictic verbs'.
September 16	BARBARA TVERSKY, Stanford U.: Events by hands and feet.
October 14	DAVID HOWARD, U. Newcastle-upon-Tyne: Semantic inhibition and facilitation in normal people and people with aphasia.
November 25	HAROLD BEKKERING, Nijmegen Institute for Cognition and Information & F.C. Donders Centre for Cognitive Neuroimaging, Nijmegen: Actions shape our world knowledge.

Many informal lectures were also presented by long-term and occasional visitors to the Institute.

13.5 The F.C. Donders Lectures on Cognitive Neuroscience

In the F.C. Donders Lecture Series on Cognitive Neuroscience outstanding researchers in the field of brain and cognition present their work and ideas to a broad audience of scholars with a diversity of backgrounds, ranging from

neuroscience to psychology and linguistics. The lecture series is jointly organized by the Max Planck Institute for Psycholinguistics and the Nijmegen Institute for Cognition and Information (NICI).

- January 24 EDMUND T. ROLLS, Oxford U.: Understanding how the brain implements vision and emotion.
- March 21 COLIN BLAKEMORE, Oxford U.: The myth of nature versus nurture.
- May 23 TOMAS PAUS, McGill U., Montreal: Exploring sensori-motor interactions by imaging and stimulating the human brain.
- September 26 SHARON THOMPSON-SCHILL, U. Pennsylvania, Philadelphia: Broca's area revisited: selection, language, and the inferior frontal gyrus.
- November 28 ELEANOR MAGUIRE, U. College London: The human hippocampus, and spatial and episodic memory.

13.6 Presentations at conferences, congresses and workshops

Aarts, E., & Turenout, M. van "Long-lasting changes in brain activity following crossmodal priming: An event-related fMRI study" [invited talk]. Lectures on Cognitive Neuroscience. Open day of the F.C. Donders Centre. Nijmegen, July.

Abdel Rahman R., & Melinger, A. "Phonological co-activation of semantic competitors and associates in picture naming." 13th Conference of the European Society of Cognitive Psychology (ESCP). Granada, September.

Abdel Rahman, R., & Roelofs, A. "Functional decomposition of semantic and phonological effects in Stroop-like picture naming with the lateralized readiness potential." 10th CNS (Cognitive Neuroscience Society) Annual Meeting. New York, March/April.

Abdel Rahman, R., & Melinger, A. "Phonologische Ko-Aktivierung bei multipler Bild-Wort Interferenz. Experimentelle Psychologie" [poster]. 45. Tagung experimentell arbeitender Psychologen (TeaP2003). U. Kiel, March.

Ameka, F.K. "Heterosemies and hyperpolysemies in Gbe: Towards constraining relexification across the Atlantic." Workshop "From Alada to Parimaribo: What happened to the languages?" Netherlands Institute for Advanced Study in the Humanities and Social Sciences (NIAS). Wassenaar, April.

Ameka, F.K., & Essegbey J. "CUT and BREAK in Sranan and Gbe." Workshop "From Alada to Parimaribo: What happened to the languages?" Netherlands Institute for Advanced Study in the Humanities and Social Sciences (NIAS). Wassenaar, April.

Ameka, F.K. "Ewe serial verb constructions in their grammatical context." International Workshop on Serial Verb Constructions. Research Centre for Linguistic Typology. La Trobe U., Melbourne, June.

Ameka, F.K. "Multiverb constructions in Kwa: Microvariation and areal typology" [invited keynote lecture]. Workshop on Multiverb Constructions in Constraint Based Grammars. Norges Teknisk-Naturvitenskapelige U. (NTNU) Summer School in Linguistics. Trondheim, June.

Baayen, R.H. "Some issues in morphological processing." Integrated Graduate Education Research and Traineeship (IGERT) Workshop. John Hopkins U., Baltimore, MD, January.

Baayen, R.H. "Linear mixed effect modeling" [invited talk]. Detroit, MI, February.

Baayen, R.H. "Semantics and the productivity of past-tense forms." Workshop at the German Research Foundation (DFG) Tagung. München, February.

Baayen, R.H. "Questioning the unquestionable. Semantic density and past-tense formation in three Germanic languages". Productivity Workshop. Paris, May.

Baayen, R.H. "The semantics of irregularity. An exercise in interdisciplinary data mining." Four Corners Workshop Series on the Relationship between Psychology and Linguistics. Max Planck Institute for Psycholinguistics. Nijmegen, May.

Baayen, R.H. "Word frequency and its formal and semantic correlates: A multivariate approach to the interpretation of word frequency." Quantitative Linguistics Conference (Qualico) 2003. Athens, WV, May.

Baayen, R.H., & Ernestus, M. "Synchronic analogy and suboptimality." Klein symposium over analogie. U. Amsterdam, May.

Baayen, R.H. "An introduction to multi-level or mixed-effect models Psycholinguistics" Workshop. Ghent, June.

Baayen, R.H., Moscoso del Prado Martin, F., Deutsch, A., Frost, R., Bertram, R., Dijkstra, T., & Schreuder, R. "Family size effects in Hebrew, Finnish, Dutch and English. A progress report." 3rd International Morphology Workshop. Aix en Provence, June.

Baayen, R.H. "Subjects, items and statistical modeling." Mental Lexicon Research Group Meeting. Vienna, October.

Baayen, R.H., & Feldman, L.B. "PCA regression." Mental Lexicon Research Group

Meeting. Vienna, October.

Baayen, R.H. "Methodological problems in psycholinguistics" [invited talk]. Nijmegen Institute for Cognition and Information (NICI). Nijmegen, October.

Bien, H. "Assimilation in morphologisch komplexen Wörtern." 45. Tagung experimentell arbeitender Psychologen (TeaP2003). U. Kiel, March.

Bien, H., Schiller, N.O., & Levelt, W.J.M. "Morpheme frequency effects in the production of Dutch compounds" [poster]. Tutorials on Behavioral and Brain Sciences Summerschool (TuBBS-2003). Leipzig, July.

Bowerman, M. "Constructing semantic categories in first language acquisition" [plenary lecture]. Georgetown U. Roundtable on Languages and Linguistics. Washington, DC, February.

Bowerman, M. "Constructing language-specific spatial categories in first language acquisition." Conference on Space in Languages: Linguistic Systems and Cognitive Categories. Paris, February.

Bowerman, M. "Space under construction: Language-specific spatial categorization in first language acquisition." Workshop on Learning and Concept Formation. Lund U., June.

Bowerman, M. "Space under construction: Language-specific spatial categorization in first language acquisition." International Conference of Cognitive Linguistics. Rioja, July.

Broeder, D., Wittenburg, P., Strömqvist, S., & Uneson, M. "Resources infrastructures – The IMDI perspective." ENABLER/ELSNET Workshop on International Roadmap for Language Resources. Paris, August.

Brown, P., Narasimhan, B., & Eisenbeiß, S. "Linguistic encoding of three-participant events" [Introduction]. Workshop on the Linguistic Encoding of Three-Participant Events: Crosslinguistic and Developmental Perspectives. Max Planck Institute for Psycholinguistics. Nijmegen, May.

Brown, P. "Learning the Tzeltal 'benefactive' construction." Workshop on the Linguistic Encoding of Three-Participant Events: Crosslinguistic and Developmental Perspectives. Max Planck Institute for Psycholinguistics. Nijmegen, May.

Brugman, H., Broeder, D., & Senft, G. "Documentation of languages and archiving of language data - The Nijmegen Model" [invited paper]. Ringvorlesung "Bedrohte Sprachen" Sprachenwert – Dokumentation – Revitalisierung. U. Bielefeld, February.

Brugman, H. "Annotated recordings and texts in the DOBES Project." Electronic Metastructure for Endangered Languages Data (EMELD) Workshop on Digitizing and Annotating Texts and Field Recordings. Summer Institute in Lansing (LSA). Michigan State U., July.

Cho, T. "Phonetic signatures of prosodic structure and their use in spoken word recognition" [invited talk]. New York U. and Northwestern U., February.

Cholin, J., Schiller, N.O., & Levelt, W.J.M. "Das mentale Silbenlexikon." 45. Tagung experimentell arbeitender Psychologen (TeaP2003). U. Kiel, March.

Cholin, J., Schiller, N.O., & Levelt, W.J.M. "Do production latencies depend on syllable frequency? The case of Dutch nonwords" [poster]. 6 Simposio de Psicolingüística. U. de Barcelona, March.

Cutler, A. "Universal and language-conditioned processes in the initial stages of word recognition." Workshop on Windows on Language Genesis. Wassenaar, November.

Davidson, D.J., Bock, K.J., & Irwin, D.E. "Tick talk" [poster]. 25th Meeting of the Cognitive Science Society. Boston, MA, July.

Dimroth, C., & Jordens, P. "The representation and change of linguistic knowledge in early learner varieties". 25. Jahrestagung der Deutschen Gesellschaft für Sprachwissenschaft. München, February.

Dimroth, C., Jordens, P., & Perdue, C. "A stage model for the acquisition of finiteness in L1 and L2." Workshop "What is Finiteness?" Max Planck Institute for Psycholinguistics. Nijmegen, March.

Enfield, N.J. "Peirce, Grice, and Keesing on location and in person: Some examples of Lao semantics in context." Workshop on Crosslinguistic Data and Theories of Meaning. Max Planck Institute for Psycholinguistics. Nijmegen, May.

Enfield, N.J. "Handling-verb constructions and 2½-place predicates in Lao." Workshop on The Linguistic Encoding of Three-Participant Events: Crosslinguistic and Developmental Perspectives. Max Planck Institute for Psycholinguistics. Nijmegen. May.

Ernestus, M., & Baayen, R.H. "Intraparadigmatic analogical effects on final devoicing." Taalkunde in Nederlanddag 2003. Utrecht, February.

Ernestus, M., Lahey, M., Verhees, F., & Baayen, R.H. "Regressieve stem-assimilatie en het Corpus Gesproken Nederlands (CGN)." Spraakmakende spraak, Workshop Corpus Gesproken Nederlands. U. Nijmegen, May.

Ernestus, M., & Baayen, R.H. "Paradigmatic effects on perception and auditory word recognition." Psycholinguistics in Flandres. Ghent, June.

Ernestus, M., & Baayen, R.H. "Paradigmatic effects on the perception of voice." Voicing in Dutch. Leiden U., June.

Ernestus, M., & Baayen, R.H. "Paradigmatic effects on perception and auditory word recognition." 13th Conference of the European Society of Cognitive Psychology (ESCOP-2003). Granada, September.

Eisner, F., & McQueen, J.M. "Does perceptual learning in speech perception generalize across speakers?" 2nd Dutch Endo-Neuro-Psycho Meeting. Doorwerth, June.

Eisner, F., & McQueen, J.M. "Speaker-specificity in perceptual adjustment to idiosyncratic speech production" [poster]. Tutorials on Behavioral and Brain Sciences Summerschool (TuBBS-2003). Leipzig, July.

Frank, S., Koppen, M., Noordman, L.G.M., & Vonk, W. "A model for knowledge-based pronoun resolution." 13th Conference of the European Society of Cognitive Psychology (ESCOP-2003). Granada, September.

Gompel, R.P.G. van, & Majid, A. "Accessing antecedents: Pronouns with infrequent antecedents are easier to process than pronouns with frequent antecedents." Conference on Architectures and Mechanisms for Language Processing (AMLaP-2003). Glasgow, August.

Gross, R., Roelofs, A., & Levelt, W.J.M. "The relationship between speech production and comprehension: At what levels do the systems talk?" [poster]. Tutorials on Behavioral and Brain Sciences Summerschool (TuBBS-2003). Leipzig, July.

Gullberg, M. "Projection in difficulty: language learners, problems, and gestures." Workshop on Projection in Interaction. Max Planck Institute for Psycholinguistics. Nijmegen, March.

Gullberg, M. "Crosslinguistic influence at hand: Gestures, topological relations, and perspectives in advanced learner production." European Second Language Association Conference on Formal and Functional Approaches to Second Language Acquisition (EUROSLA-2003). Edinburgh, September.

Haun, D.B.M. "Navigating impossible spaces" [invited talk]. Department of Psychonomics. Utrecht U., March.

Haun, D.B.M. "Body-based senses in environmental learning" [invited talk]. Max Planck Institute for Biological Cybernetics, Tübingen, June.

Haun, D.B.M., Waller D., & Loomis J. M. "Body-based senses in environmental learning." 45. Tagung experimentell arbeitender Psychologen (TeaP2003). U. Kiel, March.

Haun, D.B.M. "Travelling without moving" [invited talk]. Wellcome Department of Imaging Neuroscience, U. College London, October.

Haun, D.B.M. "Cognitive maps of impossible spaces". 2nd Dutch Endo-Neuro-Psycho Meeting. Doorwerth, June.

Hellwig, F.M., Borgwaldt, S.R., & Groot, A. de "Entropy counts: examining letter-phoneme relations in different languages." TABU-Day 2003. Groningen, June.

Hellwig, F.M., & Borgwaldt, S.R. "From onset to entropy - word initial ambiguity patterns: a crosslinguistic analysis" [poster]. 14th Meeting of Computational Linguistics in the Netherlands. Antwerpen, December.

Hoop, H. de, & Narasimhan, N., "Optimization of case in Hindi." Linguistic Society of America Winter Meeting. Atlanta, GA, January.

Indefrey, P. "Variabilität in Erwerb und Repräsentation der schwachen Substantivdeklinations des Deutschen." 25. Jahrestagung der Deutschen Gesellschaft für Sprachwissenschaft. München, February.

Indefrey, P., Hellwig, F.M., Vigliocco, G., Herzog, H., & Seitz, R.J. "Fusiform gyrus activations induced by concrete words are independent of input modality" [poster]. 9th International Conference on Functional Mapping of the Human Brain. New York, June.

Indefrey, P., Hellwig, F.M., & Shah, J. "A paradoxical strategy effect in reading" [poster]. 9th International Conference on Functional Mapping of the Human Brain. New York, June.

Indefrey, P. "Are there neural constraints on syntactic processing?" NWO Workshop on the Architecture of Sentence and Discourse Comprehension. F.C. Donders Centre. Nijmegen, August.

Jansma, B.M., Schiller, N.O., Horemans, I., & Münte, T.F. "The role of semantic and phonological characteristics in making a syntactic gender decision: an event-related brain potential study" [poster]. 6 Simposio de Psicolingüística. U. Barcelona, March.

Janzen, G. "Human spatial memory for object location and route direction" [invited talk]. Institute of Cognitive Neuroscience and Department of Anatomy, University College London, February.

Janzen, G. "Der Einfluss von Aufmerksamkeit auf die Repräsentation von Entscheidungspunkten." 45. Tagung experimentell arbeitender Psychologen (TeaP2003). U. Kiel, March.

Janzen, G. "Neural correlates of memory for object location" [invited talk]. Department of Psychonomics. Utrecht U., March.

Janzen, G. "fMRI evidence on navigational relevance of object location." 2nd Dutch Endo-Neuro-Psycho Meeting. Doorwerth, June.

Janzen, G., & Turennout, M. van "Navigational relevance of object location encoded in parahippocampal gyrus: an fMRI study." 9th International Conference on Functional Mapping of the Human Brain. New York, June.

Janzen, G. "fMRI evidence on navigational relevance of object location" [invited talk]. Lectures on Cognitive Neuroscience. Open day of the F.C. Donders Centre. Nijmegen, July.

Johnson, E.K. "English-learning infants' failure to detect onsetless word-forms: a perceptual account." 2nd Phonological Acquisition Workshop. Nijmegen, October.

Jordens, P. "When lexical verbs go finite. Dynamics of learner varieties" [invited talk]. Max Planck Institute for Psycholinguistics. Nijmegen, March.

Jordens, P. "Driving forces in the acquisition of finiteness modular interaction in Language Acquisition" [invited talk]. Free U. Amsterdam, October.

Kempen, G., & Harbusch, K. "A corpus study into word order variation in German subordinate clauses: Animacy affects linearization independently of function assignment" [poster]. 9th Conference on Architectures and Mechanisms for Language Processing (AMLaP-2003). Glasgow, August.

Kempen, G. "Performance Grammar: cognitively plausible syntax applied to visual-interactive grammar teaching" [invited talk]. Department of Linguistics, U. Southern Denmark. Odense, April.

Kempen, G. "Visueel-interactief grammaticaonderwijs." Studiedag Didaktiek voor het Nederlands. Utrecht, May.

Kempen, G. "Syntactic priming: the role of the global sentence format" [invited talk]. Closing Meeting DFG Schwerpunkt Sprachproduktion. Hamburg, June.

Kempen, G. "A psychologist's view of grammar" [invited talk]. Sonderforschungsbereich situierte künstliche Kommunikatoren. Department of Linguistics and Literature. U. Bielefeld, July.

Kempen, G. "Could the Grammatical Encoder and the Grammatical Decoder be subserved by the same structure formation resources?" [invited talk]. NWO Workshop on the Architecture of Sentence and Discourse Comprehension. F.C. Donders Centre. Nijmegen, August.

Kempen, G. "A psychologist's view of grammar" [invited talk]. Department of General Linguistics. U. Nijmegen, September.

Kempen, G. "Visueel-interactief grammaticaonderwijs." Conferentie "Het Schoolvak Nederlands". Utrecht, November.

Klein, W. "Times, arguments, and Russian aspect." Workshop on Russian Aspect. Leipzig, February.

Klein, W. "Computer und natürliche Sprache. Das Ende der Unbescheidenheit." Lecture Series of the Deutsche Physikalische Gesellschaft. Berlin, June.

Klein, W. "Finiteness, universal grammar and the language faculty." XVII International Congress of Linguistics. Prague, July.

Klein, W. "Finiteness, or: What we can agree upon and what we cannot." European Second Language Association Conference on Formal and Functional Approaches to Second Language Acquisition (EUROSLA-2003). Edinburgh, September.

Klein, W. "Perspektiven der juristischen Argumentation". Workshop of the Interdisciplinary Research Group "Sprache des Rechts". Berlin, Oktober.

Kooijman, V. van, Hagoort, P., & Cutler, A. "Woord segmentatie uit continue spraak: een ERP onderzoek met kinderen van 10 maanden." 9th Winter-conference of the Dutch Society for Psychonomics (NVP). Egmond aan Zee, December.

Küntay, A., & Özyürek, A. "Achievement of joint attention in child and adult conversations: What does the use of demonstrative pronouns reveal for pragmatic development?" International Pragmatic Research Association. Toronto, July.

Küntay, A., & Özyürek, A. "Development of achievement of joint attention in Turkish conversations: Evidence from the use of demonstrative pronouns in child and adult talk." XIth European Conference on Developmental Psychology. Milan, August.

Levelt, C.C., Fikkert, P., & Schiller, N.O. "Metrical priming in speech production" [poster]. 15th International Congress of Phonetic Sciences. Barcelona, August.

Levelt, W.J.M. "De spreker ontleed". Delivered lecture on the occasion of receiving an honorary doctorate of the University of Antwerp, May.

Levinson, S.C. "Thoughts on notions of projection." Workshop on Projection in Interaction. Max Planck Institute for Psycholinguistics. Nijmegen, March.

Levinson S.C. "Rossel and Sudest". Conference on Pioneers of Island Melanesia. King's College, Cambridge (UK), April.

Levinson, S.C. "The evolution of human spatial cognition: or how we nearly lost our bearings" [invited talk]. Conference "From Brains to Behaviour: The Evolution of Human Cognition". Leverhulme Centre for Human Evolutionary Studies. U. Cambridge (UK), November.

Linden, M. van der, Dijk, J. van, & Turenout, M. van "Context-dependent activity in auditory cortex during speech perception." 9th International Conference on Functional Mapping of the Human Brain. New York, June.

Linden, M. van der, Dijk, J. van, & Turenout, M. van "Is speech perception context dependent? An fMRI study." 9th Winterconference of the Dutch Society for Psychonomics (NVP). Egmond aan Zee, December.

Matsuo, A., Roeper, T., & Feest S. van der "Does the child assume syntactic connections between sentences?" 25. Jahrestagung der Deutschen Gesellschaft für Sprachwissenschaft. München, February.

Matsuo, A. "Do children prefer melted ice cream to melting ice cream? — L1 acquisition of participles." Finiteness Workshop. Max Planck Institute for Psycholinguistics. Nijmegen, March.

Matsuo, A., & Eisenbeiß, S. "Acquisition of case in German and Japanese." Encoding of Three-Participant Events: Crosslinguistic and Developmental Perspectives. Max Planck Institute for Psycholinguistics. Nijmegen, May.

Matsuo, A. "Effects of syntactic complexity and aspectual class on past tense production." Conference on the Acquisition of Aspect. Centre for General Linguistics, Typology and Universals Research (ZAS). Berlin, May.

Matsuo, A. "Acquisition of participles by Dutch children." 10th GALA Conference (Generative Approaches to Language Acquisition). Utrecht U., September.

Matsuo, A., & Eisenbeiß, S. "External and internal possession: a comparative study of German and Japanese child language." 28th Boston U. Conference on Language Development. Boston, MA, October/November.

McQueen, J.M. "Comprehension and production: Regular but not inseparable

bedfellows." Four Corners Workshop on the Relationship Between Language Comprehension and Language Production. Max Planck Institute for Psycholinguistics. Nijmegen, April.

McQueen, J.M. "On key human speech recognition effects." Workshop on Innovative Approaches Bridging Automatic and Human Speech Recognition. Max Planck Institute for Psycholinguistics. Nijmegen, November.

McQueen, J.M., Cutler, A., & Norris, D. "Perceptual learning in speech generalizes over words." 9th Winterconference of the Dutch Society for Psychonomics (NVP). Egmond aan Zee, December.

Majid, A. "The cues to causal perception" [invited talk]. Cognitive and computational psychophysics. Max Planck Institute for Biological Cybernetics. Tübingen, May.

Majid, A. "Contingency, covariation and causation" [invited talk]. Centre for Adaptive Behaviour and Cognition, Max Planck Institute for Human Development. Berlin, April.

Meeuwissen, M. "Tracking the eyes in producing complex spoken numerals" [invited talk]. Seminar at the Department of Experimental Psychology. Ghent U., March.

Meeuwissen, M., Roelofs, A., & Levelt, W.J.M. "Naming analog clocks conceptually facilitates naming digital clocks". 13th Conference of the European Society of Cognitive Psychology (ESCP-2003). Granada, September.

Meeuwissen, M. "Producing complex numerals for time and space" [invited talk]. Department of Psychology. U. College London, September.

Meeuwissen, M., Roelofs, A., & Levelt, W.J.M. "Gaze durations in planning complex numerals for time and space" [poster]. 9th Winterconference of the Dutch Society for Psychonomics (NVP). Egmond aan Zee, December.

Moscato del Prado Martin F., & Baayen, R.H. "Using the structure found in time: Building real-scale orthographic and phonetic representations by accumulation of expectations." The 8th Neural Computation and Psychology Workshop. Canterbury, August.

Mottaghy, F.M., Shapiro, K., Pöppel, T.D., Schiller, N.O., Flüss, M.O., Caramazza, A., Müller, H.W., & Krause, B.J. "Grammatical categories are processed in different neuronal networks: a PET study." 41. Jahrestagung der Deutschen Gesellschaft für Nuklearmedizin. Essen, April.

Narasimhan, B., Budwig, N., & Murty, L. "Discourse-pragmatic constraints on

argument realization in early child Hindi." Linguistic Society of America Winter Meeting. Atlanta, GA, January.

Narasimhan, B., & Budwig, N. "Caregiver input, argument realization, and information flow in the acquisition of argument structure: The case of Hindi." Georgetown U. Roundtable on Languages and Linguistics. Washington, DC, February.

Narasimhan, B., & Budwig, N. "Argument realization and information flow in Hindi caregiver-child discourse." Society for Research in Child Development Conference. Tampa, FL, April.

Narasimhan, B. "Agent Case-Marking in Hindi Child Language." 28th Boston U. Conference on Language Development. Boston, MA, October/November.

Noordman, L.G.M., Vonk, W., & Frank, S. "Pronoun resolution in a model for knowledge-based inferences." International Hanse Conference on Higher Level Language Processes in the Brain: Inference and Comprehension Processes. Delmenhorst, June.

O'Connor, L. "Complex predicates in Lowland Chontal." Annual SSILA/LSA (Society for the Study of the Indigenous Languages of the Americas) Meeting, Special Session on Complex Predicates in the Americas. Atlanta, GA, January.

O'Connor, L. "Parts of speech in Lowland Chontal." Americanist Colloquium, U. Nijmegen, March.

Oostdijk, N., & Broeder D. "The Dutch Spoken Corpus and its exploitation environment." 10th Conference of the European Chapter of the Association for Computational Linguistics (EACL/ LINC workshop). Budapest, May.

Özyürek, A., Allen, S., Kita, S. Kokal, I., Turanli, R., & Brown, A. "How to solve the language learning task: Speech-gesture mismatches as an index of spatial language development in Turkish children" [paper presented]. 33rd Annual Meeting of the Jean Piaget Society. Chicago, IL, June.

Papadopoulou, D., Roberts, L., & Marinis, T. "The processing of ambiguous sentences by L2 learners." 16th International Symposium on Theoretical and Applied Linguistics. Thessaloniki, April.

Papadopoulou, D., Marinis, T., & Roberts, L. "Lexical effects in sentence processing: Evidence from modifier attachment in Greek and English." 9th Conference on Architectures and Mechanisms for Language Processing (AMLaP-2003). Glasgow, August.

Pöppel, T.D., Mottaghy, F.M., Schiller, N.O., Flüß, M.O., Shapiro, K.,

Caramazza, A., Müller, H.W., & Krause, B.J. "Processing of grammatical features in noun phrase production." 41. Jahrestagung der Deutschen Gesellschaft für Nuklearmedizin. Essen, April.

Pöppel, T.D., Mottaghy, F.M., Schiller, N.O., Flüß, M.O., Shapiro, K., Müller, H. W., Caramazza, A., & Krause, B.J. "Processing of grammatical features in noun phrase production" [poster]. Human Brain Mapping 2003. New York, June.

Reesing, G. "The North Papuan Linkage, a hypothesis." Workshop on Pioneers of Island Melanesia, Cambridge, April.

Reesing, G. "A mixture of Austronesian and Papuan features." Sulka of New Britain (PNG). Leiden, November.

Rey, A., & Schiller, N.O. "Graphemic complexity and multiple print-to-sound associations in visual word recognition" [poster]. 13th Conference of the European Society of Cognitive Psychology (ESCoP-2003). Granada, September.

Roberts, L. "Effects of proficiency in the processing of long-distance Wh-dependencies by adult L2 learners of English." European Second Language Association Conference on Formal and Functional Approaches to Second Language Acquisition (EUROSLA-2003). Edinburgh, September.

Roelofs, A. "From Popper to Lakatos: A case for incremental computational modeling." Four Corners Workshop Series on the Fundamentals of Psycholinguistics. Workshop on the Relationship Between Model and Experiment. Max Planck Institute for Psycholinguistics. Nijmegen, February.

Roelofs, A. "Control of word production: response times, hemodynamics, and impairments." 6 Simposio de Psicolingüística. U. Barcelona, March.

Roelofs, A. "How does the brain solve the binding problem for language?" NWO Workshop on the Architecture of Sentence and Discourse Comprehension. F.C. Donders Centre. Nijmegen, August.

Roelofs, A. "Attention, eye movements, and verbal action: Tracking the eyes in the Stroop task." 9th Winterconference of the Dutch Society for Psychonomics (NVP). Egmond aan Zee, December.

Rosignol, S., Bosch, L. ten, Vuurpijl, L., Neumann, A., Boves, L., Os, E. den, & Ruiter, J.P. de "Human factors issues in multimodal interaction in complex design tasks." 10th International Conference on Human - Computer Interaction (HCI 2003). Crete, June.

Ruiter, J.P. de, "Multimodal turn-taking in dyadic negotiation." ILASH (Institute of Language, Speech and Hearing) Workshop on Multimodal Information

Processing. U. Sheffield, February.

Salverda, A.P., Dahan, D., Tanenhaus, M.K., Masharov, M., Crosswhite, K., & McDonough, J. "Prosodic structure influences lexical activation in spoken-word recognition." 12th European Conference on Eye Movements. Dundee, August.

Salverda, A.P., Dahan, D., Tanenhaus, M.K., Masharov, M., Crosswhite, K., & McDonough, J. "Activation of competitor words in different prosodic contexts" [poster]. 16th Annual CUNY Conference on Human Sentence Processing. Cambridge, MA, March.

Schiller, N.O., & Caramazza, A. "Grammatical gender selection in language production: The case of Dutch diminutives." 45. Tagung experimentell arbeitender Psychologen (TeaP2003). U. Kiel, March.

Schiller, N.O., Neyndorff, A., Schuhmann, T., & Schmitt, B.A. "The influence of category membership on syntactic decisions: A study using event-related brain potentials" [poster]. 10th Annual Meeting of the Cognitive Neuroscience Society. New York, March.

Schiller, N.O. "Self-monitoring, inner speech, and record keeping." Four Corners Workshop Series on the Relation Between Production and Comprehension. Max Planck Institute for Psycholinguistics. Nijmegen, April.

Schiller, N.O. "The nature of the form-priming effects in the naming task" [poster]. 6 Simposio de Psicolingüística. U. Barcelona, March.

Schiller, N.O. "Metrical stress in speech production: A time course study." 15th International Congress of Phonetic Sciences. Barcelona, August.

Schiller, N.O., & Caramazza, A. "Grammatical gender selection in language production: the case of Dutch diminutives". 13th Conference of the European Society of Cognitive Psychology (ESCOP-2003). Granada, September.

Schiller, N.O., & Caramazza, A. "The production of diminutives in Dutch." 44th Annual Meeting of the Psychonomic Society. Vancouver (Canada), November.

Schiller, N.O., & Caramazza, A. "Diminutive production in Dutch". 9e Winterconferentie van de Nederlandse Vereniging voor Psychonomie. Egmond aan Zee, December.

Schmiedtová, B. "The expression of simultaneity in learner varieties". European Second Language Association Conference on Formal and Functional Approaches to Second Language Acquisition (EUROSLA-2003). Edinburgh, September.

Seifart, F. "Nominal classification in Witotoan languages: towards a comparison."

51st International Congress of Americanists. Santiago de Chile, July.

Seifart, F. "La clasificación de los animales y las plantas en Bora" [invited talk]. Instituto de Investigaciones de la Amazonía Peruana (IIAP). Iquitos, July.

Seifart, F. "Haciendo etnolingüística en el Amazonas" [invited talk]. U. de los Andes, Bogotá, September.

Senft, G. "The Nijmegen Space Games" [invited paper]. International Symposium on Space Games: New Research Approaches to Spatial Orientation, Spatial Perception and Spatial Cognition. Internationales Wissenschaftsforum der U. Heidelberg, May.

Senft, G. "Genres and metalinguistic expressions for speech action patterns in the language of the Trobriand Islanders." 8th International Pragmatics Conference. Toronto, July.

Seuren, P.M.A. "Production and parsing: one or two?" Conference of the European Society for the Social and Cognitive Sciences (ESSCS). Freiburg, August.

Seuren, P.M.A. "Oaks and acorns." Annual Conference of the Societas Linguistica Europaea at the École Normale Supérieure Lettres et Sciences Humaines. Lyon, September.

Seuren, P.M.A. "Language as social commitment." Seminar on Windows on the evolution of language. Netherlands Institute for Advanced Study in the Humanities and Social Sciences (NIAS). Wassenaar, November.

Seuren, P.M.A. "Harris and Generative Semantics vindicated: The case of German V-clusters" [invited talk]. Zellig Harris Memorial Colloquium. U. Philadelphia, PA, January.

Skiba, R., Brugman, H., & Wittenburg, P. "State and development of the DOBES archive". DOBES Workshop. Frankfurt, April.

Skiba, R. "Annotation von digitalisierten Sprachdaten in Spracherwerbsforschung und bei Dokumentation bedrohter Sprachen" [invited talk]. Free U. Berlin, December.

Sprenger, S., Kempen, G., Levelt, W.J.M. & Rijn, H. van "A frequency count of fixed expressions in Dutch" [poster]. 13th Conference of the European Society of Cognitive Psychology (ESCAP-2003). Granada, September.

Snijders, T.M., Kooijman, V., Hagoort, P., & Cutler, A. "ERP repetition effects during cross-language word segmentation." 9th Winterconference of the Dutch

Society for Psychonomics (NVP). Egmond aan Zee, December.

Staden, M. van, & Majid, A. "Word meaning: Two methodologies for investigating body part nomenclature." Workshop on Crosslinguistic Data and Theories of Meaning. Max Planck Institute for Psycholinguistics. Nijmegen. May.

Staden, M. van, & Majid, A. "Word meaning: Investigating body part nomenclature" [invited talk]. Free U. Amsterdam, June.

Terrill, A. "Testing punctuated equilibrium in the Solomon Islands." Centre for Research on Language Change. Australian National U., Canberra, July.

Terrill, A. "Punctuated equilibrium in the Solomon Islands." 16th International Conference on Historical Linguistics. Copenhagen, August.

Turenout, M. van "Woorden in het brein" [invited talk]. Studium Generale Lecture Series on Hersenen en Gedrag. CREA theater Amsterdam, October.

Turenout, M. van "Woorden in het brein: Functioneel MR onderzoek naar hersenactiviteit tijdens taalverwerking" [invited talk]. Simea Congres 2003 Elkaar verstaan! Lunteren, April.

Turenout, M. van, Linden, M. van der, Wagensveld, B., Toni, I. "Cortical plasticity in phonetic representations during speaking". 9th International Conference on Functional Mapping of the Human Brain. New York, June.

Vonk, W., Rijn, H. van, & Radach, R. "Eye guidance and the saliency of beginnings of long and short words." 12th European Conference on Eye Movements. Dundee, August.

Vonk, W., Schriefers, H., & Mak, W.M. "Reading relative clauses: Subjects, topics, and animacy." Workshop "Syntax and Beyond". Leipzig, August.

Vonk, W. "Contrastive 'but' and negation affect the interpretation and availability of concepts." 13th Conference of the European Society of Cognitive Psychology (ESCP-2003). Granada, September.

Weber, A., & Cutler, A. "Perceptual similarity co-existing with lexical dissimilarity." 146th Meeting of the Acoustical Society of America (ASA). Austin, TX, November.

Wittenburg, P. "Metadata initiative for LR - State and perspectives." Open Forum on Metadata Registries. Santa Fe, NM, January.

Wittenburg, P. "Lexicon schemas, registries and repositories - an introduction." ISO TC37/SC4 Workshop on Lexicon Schema, Registries and Repositories. München, February.

Wittenburg, P. "Lego bricks for lexicons." ISO TC37/SC4 Workshop on Lexicon Schema, Registries and Repositories. München, February.

Wittenburg, P. "Virtual wisdom – A Metadata domain for the MPG." Workshop on Perspectives for digital long-term preservation. Gesellschaft für wissenschaftliche Datenverarbeitung (GWDG). Göttingen, February.

Wittenburg, P. "Metadata models and accessibility of digital archives." Workshop "Perspectives for Digital long-term Preservation". Gesellschaft für wissenschaftliche Datenverarbeitung (GWDG). Göttingen, February.

Wittenburg, P. "The DOBES Model of language documentation." International Expert Meeting on the UNESCO Programme on Safeguarding of Endangered Languages. Paris, March.

Wittenburg, P. , Szöllösi-Brenig, van "Volkswagen Foundation and its funding programme - Documentation of endangered languages." International Expert Meeting on the UNESCO Programme on Safeguarding of Endangered Languages. Paris, March.

Wittenburg, P. "The DOBES Model of language documentation." Workshop on Endangered Languages. Endangered Languages Documentation Programme (HRELP). London, March.

Wittenburg, P. "Environment for Metadata work." ECHO Sign Language Workshop. Max Planck Institute for Psycholinguistics. Nijmegen, May.

Wittenburg, P. "Monokulturen - Verlust der Sprachenvielfalt." 10. Wissenschaftliche Sommerakademie Ethik und Gesellschaft der Universität Wien und Gemeinde Kapfenberg. Kapfenberg, June.

Wittenburg, P. "Architectures for distributed language resources." 17th International Congress of Linguists (CIL XVII). Prague, July.

Wittenburg, P. "Perspectives for accessing and safeguarding endangered languages archives." Digital Resources for the Humanities Conference (DRH-2003). Cheltenham, August.

Wittenburg, P. "Archiving strategies for multimedia language documentation." Paradises Conference on Audio Archiving. Sydney, October.

Wittenburg, P. "Aspects of documenting endangered languages." Workshop on Archiving. Endangered Languages Documentation Programme (HRELP). London, November.

13.7 Colloquia presented

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

- AMEKA "Beyond names as socio-cultural records." Institute of Asian and African Studies, Humboldt U. Berlin.
 "From JUSSIVE to CONSECUTIVE CONNECTOR: The cognitive archeology of the marker né in Ewe." Monday Seminar Series, School of Languages and Linguistics, Australian National U., Canberra.
 "CUT and BREAK verbs in the multiplex Atlantic linguistic area: semantic typology and areal perspective." School of Communication, Arts and Critical Enquiry, La Trobe U.
 "CUT and BREAK verbs on the West African Littoral: an areal semantic perspective." Colloquium Africana Linguisticum, Institut für Afrikanische Sprachwissenschaften, Wilhem-Goethe U., Frankfurt-a.M.
- CUTLER "Phonetic precision in listening." U. Essex, Colchester.
 "Inducing language change in the laboratory." Saarland U., Saarbrücken.
- DIMROTH "Differences in child and adolescent L2 acquisition. A longitudinal case study." U. Cambridge.
- ENFIELD "Cultural logic and syntactic productivity." U. Amsterdam.
 "Three-participant events in Lao." U. Stockholm.
 "Kinship and fish traps in Lao hand gestures. Method and theory in field research on multimodal representation." Institute for Ethnology, U. Heidelberg.
- GULLBERG "L'expression orale et gestuelle de la cohésion dans le discours de locuteurs langue 2 débutants." U. Paris VIII.
 "Why gestures are relevant to issues of multilingual language use. Communicative and cognitive perspectives." U. Dublin, Trinity College.
- INDEFREY "The neurocognition of syntactic processing." U. Essex.
 "In search of the dual route: hemodynamic studies on reading." MPI of Cognitive Neuroscience, Leipzig.
- SCHILLER "Speech production, grammatical feature processing, and self-monitoring." Laboratoire de Psychologie Cognitive (CNRS) & U. de Provence, Marseille.
 "Grammatical feature selection in language production." EPOS (Experimentaal Psychologisch Onderzoekschool) dag. U. Amsterdam.
- SEUREN Lecture series: "Language, cognition and functionality". U. Stellenbosch, South Africa.

13.8 Teaching

Members of the Institute taught at the following institutions:

- BOWERMAN "De semantische ontwikkeling in de verwerving van de eerste taal."
Free U. Amsterdam.
"Topics in psycholinguistics, Part II: Semantic development in first language acquisition." Free U. Amsterdam.
"Language acquisition and semantic typology." Summer School in Linguistic Typology, Cagliari.
- DAVIDSON "Toolkit of Cognitive Neuroscience." F.C. Donders Centre, Nijmegen.
- ENFIELD "Linguistic areas: Description and analysis." LOT Winter School, Amsterdam.
"Language Acquisition (Lao as a second language)." U. Nijmegen.
"Lectures on cognitive semantics and pragmatics." U. Oerebro.
- GULLBERG "Gestures and SLA: The role of the native language." Seminar in course: The role of the native language. (Dr. Eric Kellerman), U. Nijmegen.
"Language and gesture." Hauptseminar/course Wintersemester, U. Mannheim.
- INDEFREY Seminar "Psycholinguistik des Sprachverstehens." U. Düsseldorf.
Workshop "Psycholinguistics." Graduiertenkolleg Universalität und Diversität. Leipzig.
Toolkit course lecture: "The ins and outs of PET." F.C. Donders Centre, Nijmegen.
Psychonomics course lecture: "Hemodynamic methods." U. Nijmegen
- KEMPEN Psycholinguistic Course. Department of Psychology, Leiden U.
- KLEIN Seminar: "Zweitsprachenerwerb." U. Heidelberg.
- LEVINSON "Evolutie en taal." Honours Program, U. Nijmegen.
- ROBERTS "On-line Research Methods for Psycholinguistics." Graduate induction course. U. Essex.
- DE RUITER Seminar: "Advanced statistical methods in reaction time research." U. Geneva.
- SCHILLER "Taal [Language]." Faculty of Psychology, U. Maastricht.
Seminar "Taal". Lecture in blok 1.5B "Menselijk kennen." Faculty of Psychology, U. Maastricht.
Seminar: "The Moses Illusion." Opening lecture for Onderzoekspraktikum 2.7. Faculty of Psychology, U. Maastricht.
Onderzoekspraktikum 2.7: "Onderzoek - How to do it?" [Research internship 2.7: "Research - How to do it?"]. Faculty of Psychology, U. Maastricht.

- "The neurocognition of language." Keuzeblok 4.1. Faculty of Psychology, U. Maastricht.
- SENFT Seminar: "Endangered Languages." U. Köln.
Seminar: "The Trobriand Islanders of Papua New Guinea." Session in Ad Borsboom's introductory seminar on anthropological research in Oceania, U. Nijmegen.
- VONK "Psycholinguïstiek" U. Nijmegen.
"Het begrijpen van tekst." U. Nijmegen.

14 PUBLICATIONS

- Abdel Rahman, R., & Sommer, W. (2003). Does phonological encoding in speech production always follow the retrieval of semantic knowledge? Electrophysiological evidence for parallel processing. *Cognitive Brain Research*, 16, 372-382.
- Abdel Rahman, R., Turenhout, M. van., & Levelt, W.J. M. (2003). Phonological encoding is not contingent on semantic feature retrieval: An electrophysiological study on object naming. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 29, 850-860.
- Adank, P., Smits, R., & Hout, R. van (2003). Modeling perceived vowel height, advancement, and rounding. *Proceedings of the 15th International Congress of Phonetic Sciences (ICPhS 2003), Barcelona*, (pp. 647-650).
- Akker, E., & Cutler, A. (2003). Prosodic cues to semantic structure in native and non-native listening. *Bilingualism: Language and Cognition*, 6, 81-96.
- Alario, F.-X., Schiller, N.O., Domoto-Reilly, K., & Caramazza, A. (2003). The role of phonological and orthographic information in lexical selection. *Brain and Language*, 84, 372-398.
- Allen, S., Özyürek, A., Kita, S., Brown, A., Turanli, R., & Ishizuka, T. (2003). Early speech about manner and path in Turkish and English: Universal or language-specific? In B. Beachley et al. (Eds.), *Proceedings of the Boston University Conference on Language Development* (pp. 63-72). Somerville, MA: Cascadia Press.
- Ameka, F.K. (2003). Prepositions and postpositions in Ewe: Empirical and theoretical considerations. In A. Zibri-Hetz & P. Sauzet (Eds.), *Typologie des langues d'Afrique et universaux de la grammaire* (Vol. 2: Benue-kwa, Soninke, Wolof, pp. 43-66). Paris: L'Harmattan.
- Ameka, F.K. (2003). "Today is far": Situational anaphors in overlapping clause constructions in Ewe. In M.E.K. Dakubu & E.K. Osam (Eds.), *Studies in the Languages of the Volta Basin 1. Proceedings of the Legon-Trondheim Linguistics Project* (pp. 9-22). Legon: Department of Linguistics, University of Ghana.
- Baayen, R.H., & Schreuder, R. (2003). *Morphological structure in language processing*. Berlin: Mouton de Gruyter.
- Baayen, R.H. (2003). Probabilistic approaches to morphology. In R. Bod, J. Hay, & S. Jannedy (Eds.), *Probabilistic linguistics* (pp. 229-287). Cambridge, MA: MIT Press.
- Baayen, R.H., McQueen, J.M., Dijkstra, T., & Schreuder, R. (2003). Frequency effects in regular inflectional morphology: Revisiting Dutch plurals. In R.H. Baayen & R. Schreuder (Eds.), *Morphological structure in language processing* (pp. 355-390). Berlin: Mouton de Gruyter.

- Baayen, R.H., Moscoso del Prado Martin, F., Wurm, M.L., & Schreuder, R. (2003). When word frequencies do NOT regress towards the mean. In R.H. Baayen & R. Schreuder (Eds.), *Morphological structure in language processing* (pp. 463-484). Berlin: Mouton de Gruyter.
- Blumstein, S., & Cutler, A. (2003). Speech perception: Phonetic aspects. In W. J. Frawley (Ed.), *International Encyclopaedia of Linguistics* (2nd ed., Vol. 4, pp. 151-154). Oxford: Oxford University Press.
- Bohnemeyer, J. (2003). The unique vector constraint: The impact of direction changes on the linguistic segmentation of motion events. In E. van der Zee & J. Slack (Eds.), *Axes and vectors in language and space* (pp. 86-110). Oxford: Oxford University Press.
- Bohnemeyer, J. (2003). Invisible time lines in the fabric of events: Temporal coherence in Yukatek narratives. *Journal of Linguistic Anthropology*, 13(2), 139-162.
- Bowerman, M., & Choi, S. (2003). Space under construction: Language-specific spatial categorization in first language acquisition. In D. Gentner & S. Goldin-Meadow (Eds.), *Language in mind: Advances in the study of language and thought* (pp. 387-427). Cambridge, MA: MIT Press.
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