**American Journal of Computational Linguistics** *Microfiche 42*

# THE FINITE STRING

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ABSTRACTS OF PAPERS

ON COMPUTATIONAL LINGUISTICS

# L I N G U I S T I C  S O C I E T Y

# O F  A M E R I C A

## 1-9 7 5  Annual Meeting

A session was organized by Aravind K Joshi on behalf of ACL. The abstracts are reprinted on the following pages from the Meeting Handbook, with the permission of the Society

# A MODEL FOR FUNDAMENTAL FREQUENCY BASED ON COMMUNICATIVE FUNCTION

Jonathan Allen

*Massachusetts Institute of Technology*

By examining the communicative speech act performed with an utterance, a comprehensive model for the generation of fundamental frequency contours can be derived. Each utterance is considered to have propositional, interpersonal, and discourse function, and the model shows how each of these determine a relation between the underlying syntax and semantics, and the surface fundamental frequency. The underlying performative and proposition control the basic contour shape, which is then perturbed by markers of the speaker's attitude toward the proposition and the choice of focus-shifting transformations. The interpersonal function is supplied by modal operators which indicate the speaker's attachment to the truth-value of the proposition, and we show how modals and their scope are realized in the fundamental frequency contour The use of focus-shifting transformations to achieve discourse effects is also strongly marked by pitch movements, and these are characterized for a wide range of transformations. All of these effects are shown to be essential for a comprehensive model of pitch contours.

# NEGATION: GRAMMATICAL, SEMANTICAL, AND PRAGMATICAL

Felix Dreizin

*Bar-Ilan University*

It is generally agreed upon that presuppositions are not affected by negation. This is not so for a vast class of speaker presuppositions--those about the information at the disposition of the hearer. Example: with respect to the sentence 'It was not John who killed Mary' a presupposition of the above kind ('John killed Mary ) is normally affected by uttering this sentence. I propose to distinguish between three kinds of negation: (a) grammatical (GN) "not"; (b) semantical (SN) if "missed" is described with respect to a basic semantic unity "hit", then "missed" = NEG (hit), (c) pragmatical (PN): "no": rejecting a piece of information which the hearer is assumed to be aware of. This yields eight sentence types ('A' stands for "Assertion").

| | | |
|---|---|---|
| (1) | SN GN PN | It wasn't John who killed Mary. |
| (2) | SN GN PA | ? Seems not to exist. |
| (3) | SN GA PN | He missed the target. (Contrastive stress) |
| (4) | SN GA PA | He missed the target. |
| (5) | SA GN PN | He didn't miss the target. |
| (6) | SA GN PA | ? Seems not to exist. |
| (7) | SA GA PN | It was John (rather than Mary) who killed Bill. |
| (8) | SA GA PA | He hit the target. |

The subtle differences between semantically equivalent sentences (5) and (8) can be ascribed to the opposition PN vs. PA. The above framework is a useful tool to account for negation in discourse.

# NATURAL LANGUAGE ANALYSIS IN A FUNCTION ORIENTED SYSTEM

G. C. Goldbogen
*Union College*

E. C. Chylinski
*General Electric Corporate Research and Development*

For English comprehension and deduction in an interactive system, an ATN produces a binary syntactic tree; semantic analysis collapses the tree and yields a LISP program representation, used in one module as a function on the system data base and in the other as a WFF to be verified from the data base. FORNAP (function oriented natural language processor) grew out of SIGS, written at SUNY Albany for graph theory. A domain of discourse consists of elements and functions; in graph theory, elements are points, lines, graphs, integers, and boolean T, F; one function is COMPONENTS, mapping graphs into integers. The ATN model restricts English; restricting each word to a single part of speech results in no ambiguity for legal sentences. The semantic collapse is bottom up, it works with rightmost parent node with two terminal sons, using syntax, dictionary, and argument table. Some triples cause arguments to be checked semantically and staeked for later reference; other types cause pieces of the WFF to be assembled, possibly using stacked data. Applications using WFFs in the theorem proving module.

# CLAIM STRUCTURE·GRAMMAR

Linda Misek
Vassar College

Kaplan is optimistic that Woods-type "augmented transition network" grammars can capture the psychological reality of human language processing by modeling linguistic performance and competence. Cognitive mappings from surface strings are also of interest to Schank, whose "conceptual dependencies" infer deep-case relations from parsable features. Both approaches promise to lead us from language to patterns of thought. This paper presents recent developments in Claim Structure Grammar a stratified system representing real world text as sets of conceptual "claims" or assertions which bind entities, relations, and their properties. CSG postulates thematic deep structures by conceptually interpreting events at nodes and on transition arcs in surface networks. Discourse parsed for "claims" may be a well-formed text, sentence, or clause--or simply a fragment whose terms nonetheless entail ontological commitments. The form of CSG is a transition net, its function is to differentiate among the users of a language and among the separate states through which an individual speaker or writer transitions in process of communicating world knowledge. Originally developed in the context of rhetoric and stylistics, CSG gains in power and significance when viewed from the computational perspectives of Woods, Schank, and others.

# USE OF NATURAL LANGUAGE IN COMPUTER PROOF CHECKING

Robert Smith & Lee Blaine

*Stanford University*

The EXCHECK system is a proof checker designed to check and discuss student proofs given in a style approaching that of standard university mathematics. EXCHECK is currently being used to teach axiomatic set theory at Stanford. Informal mathematical proofs suppress an enormous amount of detail that simply gets in the way of understanding the proof. The suppression of this detail involves the use of natural language, incorporating many of the known problems such as elliptic and contextual references, operator scope and precedence, and the use of semantic information. In order to check such proofs, it is necessary to understand the relationship between rigorous mathematical proofs and their informal presentation in a mathematics curriculum. Film and slides show the current version of the EXCHECK proof checker, with emphasis on the NL aspects. Furthermore, we discuss our efforts to represent the structure of a student's developing proof EXCHECK runs on the IMSSS PDP10/TENEX timesharing system at Stanford

# A SYSTEM FOR COMPUTING PRESUPPOSITIONS AND ENTAILMENTS

Ralph Weischedel

*University of California, Irvine*

Presupposition and entailment are a subclass of inferences tied to the structure of a language. Presuppositions may arise from syntactic structure and from the meaning of individual words; entailments arise from the meaning of particular words. Since they are tied to the structure of language, they may be computed by tree transformations, independent of context not inherent in the structure of a sentence. This is a particularly simple computation, in sharp contrast to other computational mechanisms suggested for the general class of inferences. Other aspects of the uniqueness of presuppositions and entailment as a class of inferences will be considered. A program which accepts as input individual sentences and gives as output the presuppositions and entailments of each sentence will be described.

# CURRENT BIBLIOGRAPHY

The tentative rules for selection of material and the tentative subject categories used to classify it are about to disappear. The number of members responding to this year's directory call is more than 100; the number of categories checked per member is so large as to signify a misfit between the categories and the members' self descriptions. A cluster analysis is being made in an informal way; the clusters will be adopted as new subject headings, replacing or extending the present system. The new categories will appear in the index to be delivered in about a month and in the next issue of The Finite String.

The number of members interested in certain topics (see Microfiche 37) is so small as to raise questions about the effort expended to provide bibliographic coverage. After consultation with the Editorial Board, the Editor expects to terminate coverage of some areas--unless our handling of those areas is superior to other abstract journals, and our quality can be used to attract more members quickly.

*See the following frame for a list of subject headings with frame numbers.*

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## Learning, Automatic Language Analysis: Their Application to Information Retrieval

*Apprentissage, analyse automatique du langage, application a la documentation*

**A. Andreewsky, C. Fluhr, and Debraine**
*Centre d'Etudes Nucleaires, Saclay, France*

*Document de Linguistique Quantitative, No. 20; Paris: Dunod, 1973, $20.00*

A collection of papers reporting aspects of work by the Groupe de linguistique automatique at CEN-Saclay: Strategy for a learning program for computational linguistics; Algorithms for synthesizing French sentences; A system of discriminative analysis, machine indexing, hierarchical document search, and decision aids. The last combines a Bayesian model with the output from automatic parsing and semantic analysis.

GENERAL

## Outline of Natural Language Systems

**S. Yoshida**
*Department of Computer Science, Kyushu Institute of Technology, Tobata, Kitakyushu, Japan*

*Memoirs of the Kyushu Institute of Technology, No. 5:59-71, March 1975*

Develops systems (NL systems) for describing human thinking processes by means of natural language. Basic hypotheses giving base for describing thinking processes in natural language are stated. Outlines of whole system constructions and their behaviors on these bases are presented. The feature of the NL systems is that they are constructed from the standpoint of engineering and, therefore, many useful sub-systems may be constructed from these systems.

## Five Lectures on Artificial Intelligence

Terry Winograd
*Stanford University*

*NTIS: AD/A-000 085/1, September 1974*
*PC $4.75/MF $2.25*

Contents: Computer systems for natural language; SHRDLU, a system for dialogue; Representation, formalisms for knowledge; Frames; some ideas for a new formalism; Conceptual programming, applying artificial intelligence to program writing.



## Automatic Segmentation of Speech into Syllabic Units

Paul Mermelstein
*Haskins Laboratories, New Haven, Connecticut*

*Journal of the Acoustic Society of America 58:880-883, 1975*

The segmentation algorithm judges whether a loudness minimum is a syllabic boundary, using the difference between the convex hull of the loudness function and the loudness function itself. Tested on roughly 400 syllables of continuous text, the algorithm results in 6.9% syllables missed and 2.6% extra syllables relative to a nominal, slow-speech syllable count. The algorithm doesn't proceed from left to right in time, but where real-time operation is essential it could be modified to operate left to right with backtracking over an interval no greater than 500 msec.

## Real Time Analysis of Voiced Sounds

**J. P. Hong**
*National Aeronautics and Space Administration, Pasadena, California*

*Patent Application NASA-CASE-NPO 13465-1 NTIS: PAT-APPL-531 575*
*PC $3.25/MF $2.25*

A power spectrum analysis of the harmonic content of a voiced sound signal is conducted in real time by phase-lock-loop tracking of the fundamental frequency of the signal and successive harmonics *hl* through *hn* of the fundamenatal frequency. The quadrature power and phase of each frequency tracked is measured, differentiating the power measurements of the harmonics in adjacent pairs and analyzing successive differentials. The differentials are used to determine peak power points in the power spectrum for display or use in analysis of voiced sound, such as for voice recognition.



## Auditory Speech Features: The Sound of English as Processed by a Model of the Ear

**John L. Godfrey**
*Ohio Research Institute, University of Dayton*

*Report AMRL-TR-74-41, September 1974 NTIS: AD/A-002 604/7GA*
*PC $3.75/MF $2.25*

The model identifies vowels by features closely resembling spectral formants. Fine temporal detail is preserved, which is useful for sounds characterized by rapid changes in the signal. Duration, pitch and diphthongalization are registered. The model works well for the consonants studied, preserving fine temporal detail. Some consonant features required special purpose circuitry. Also discussed are strategies, based on the phonetic composition of some sounds, for writing integrated phonemic recognition algorithms; results of some preliminary tests are presented.

## Analysis of Intonational Signals by Computer Simulation of Pitch-Perception

Y. Takefuta
*Department of Speech Communication, Ohio State University, Columbus 43210*

*Report TR-15, February 1974; NTIS: AD 776/647*
*PC $3.25/MF $2.25*

A computer program is developed to extract fundamental frequencies, intensity variations, and duration characteristics. A second program normalizes melody curves and segments them into constituent units of intonation patterns. A third program analyses normalized melody curves and identifies pitch patterns based upon the regression analysis of pattern features.



## Automatic Verification of Hypothesized Phonemic Strings in Continuous Speech

R. A. Gillman
*System Development Corporation, Santa Monica, California 90406*

*Report SDC-TM-5315/000/00, 10 May 1975; NTIS: AD-779/306/0GA*
*PC $3.00/MF $2.25*

A parser (with 30 rewrite rules) predicts a set of possible words, including initial words from a vocabulary of 160 words. A lexicon contains phonemic spellings and approximate duration times for each phoneme of a word. A phonemic-acoustic mapping program is based on five rough segment labels: silence; low-amplitude, voiced or unvoiced; vowel-like; strong frication; other. Two phonemic locators (vowels and sonorants, and consonants) use the range boundaries given by the lexicon to search the acoustic string. Phonemes are processed according to a goodness score which is a function of the phoneme's distance to the nearest fixed boundary and of the class of the phoneme. In a trial of 20 utterances, the program was able to identify the correct word in first place 89% of the time.

## Acoustic Phonetic Research in Speech Understanding

**Richard W. Becker, and Fausto Poza**
*Stanford Research Institute, Menlo Park, California*

*IEEE Transactions on Acoustics, Speech, Signal Processing 23:416-426, 1975*

The entire system uses pragmatic, semantic, and syntactic information to propose candidate words at specific points in the acoustic stream which are accepted or rejected by the acoustic processor. This verification is done in two stages. First, each 10-ms segment is classified as one of ten primitive classes by digital filtering. If the proposed word is consistent with the pattern of primitive classes at the corresponding point in the acoustic stream, further analysis is done using linear predictive coding and other digital filters. The results of this analysis are used to segment the acoustic signal and to further classify the voiced segments. Because this segmentation and classification can be tailored for each word, difficult analysis problems caused by coarticulation between adjacent sounds can be successfully solved



## Analysis and Recognition of Voiceless Fricative Consonants in Japanese

**Hiroya Fujisaki, and Osamu Kunisaki**
*Department of Electrical Engineering, Faculty of Engineering, University of Tokyo, Japan*

*Annual Bulletin, Research Institute of Logopedics and Phoniatrics, University of Tokyo, 9:123-126, 1975*

Based on an equivalent circuit representation of the production mechanism for the voiceless fricative consonants /s/ and /sh/ (in Japanese), a model is derived for their frequency spectra up to 5 kHz. Using 60 words of CV and CVC type containing these consonants, spectra were obtained and measured and found to agree with the model, suggesting the use of the model for automatic recognition.

## Automatic Recognition of Semivowels in Spoken words

**Hiroya Fujisaki**
*Research Institute of Logopedics and Phoniatrics, University of Tokyo*

**Yasuo Sato, Yoshiro Noguchi, and Takao Yamakura**
*Department of Electrical Engineering, University of Tokyo*

*Annual Bulletin: Research Institute of Logopedics and Phoniatrics, University of Tokyo, 9:119-122, 1975*

At the first stage of the recognition process the input speech is segmented by Analysis-by-Synthesis of formant trajectories into intervals that possess a set of target formant frequencies corresponding to the Japanese vowels /a/, /i/, /u/, /e/, and /o/. /a/, /e/, and /o/ can be uniquely recognized at this stage. As the formant frequencies of the vowels /i/ and /u/ are respectively identical to those of the semivowels /j/ and /w/, a second stage of analysis is needed which utilizes information about duration and speech rate. A recognition experiment has been performed on a total of 300 utterances of both meaningful and nonsense words and a high recognition rate was achieved.



## Perception of Time-Varying Resonance Frequencies In Speech and Non-Speech Stimuli

**Hiroya Fujisaki, and Sotaro Sekimoto**
*Research Institute of Logopedics and Phoniatrics, University of Tokyo*

*Annual Bulletin: Research Institute of Logopedics and Phoniatrics, University of Tokyo, 9:127-136, 1975*

Based on the analysis of formant transitions in natural speech, synthetic speech stimuli were generated with various values of magnitude, rate, and duration of formant transitions. Discrimination tests of dynamic and static stimuli indicated the existence of perceptual extrapolation that underlies formant transitions. Results of discrimination tests on non-speech stimuli with similar formant transitions suggested that the extrapolation was to a large extent auditory, and thus was not specific to perception of speech stimuli. On the other hand, identification tests of dynamic and static speech stimuli clearly indicated the short-term context effect in perception of connected segments, which was quantified as the amount of temporary shift in the threshold for phonemic judgment due to perception of the immediately preceding segment.

## Syllable Recognition Using an Adaptive Pattern Recognition Technique

**M. Ali, and R. Ahmed**
*Aligarh Muslim University, India*

*Journal of the Institution of Electronics and Telecommunications Engineers 19: 676-683, December 1973.*

Sonograms of CVC syllables spoken by a single male speaker, and VC, CV, CVC syllables spoken by two male speakers were converted into 140-dimensional and 144-dimensional quantized patterns. When the components are optimally weighted before being summed, the weighted sum can serve as the basis of recognition. An index of correct recognition has been defined and a rule for arriving at the correct weights of the individual components has been stated. An automatic weight determining device is proposed to optimize the weights during the learning phase of the machine.



## Simulation of a Recognition System for Connected Speech Sounds Using Linguistic Information

**S. Takeya, and F. Kawaguchi**
*Kyushu University, Fukuoka, Japan*

*Electronics and Communications in Japan 56, No. 9:34-46, September 1973*

Imperfect sound sequences which have been recognized on the basis of physical features are transformed into a variety of possible character sequences. The latter are then transformed into a variety of possible character sequences. The latter are then transformed into word sequences which are then adjusted for sentence structure. This process eliminates sequences which do not satisfy the rules of syntax. In computer simulation of this system, the input sound sequences were unclear weather forecasts (124 texts). Listening tests were conducted and it was found that for an input of about 60% correct sequences the output was improved to about 93%.

## Talker Recognition by Statistical Features of Speech Sounds

S. Furui, and F. Itakura
*NTT, Musashino, Japan*

*Electronics and Communications in Japan 56, No. 11:62-71, November 1973*

Speech sounds of several words are represented by time sequences of partial auto-correlation coefficients and fundamental frequency. Talker recognition experiments are based on feature parameters and include several statistical measures such as averaged values, standard deviation and correlation coefficients between parameters. Several words are used for the decision. When reference samples are obtained from four measurements at 3-month intervals and four words are combined, an average recognition rate of 99.1% is obtained in identifying one talker from 9 and 99.2% for verifying one talker in 37 after 3 months from the last reference sample. The long-term variation of feature parameters, which causes recognition error, is considered and the results indicate quantitatively that, although the parameters are stable for several days, variations become large afterward.



## Speech Feature Extraction by a Modulated Fourier Function

N. Miki
*Hokkaido University, Sapporo, Japan*

C. Yoshimoto

*Electronics and Communications in Japan 57, No. 1:56-63, January 1974.*

A method of estimating the speech spectrum envelope employs the Fourier transform of the impulse response $h(t)$ of the filter obtained by solving Wiener's inverse filter problem. Noting that if $t$ is made sufficiently large the impulse response converges toward zero, the authors have considered expansion of $h(t)$ in terms of a system of damped oscillating orthogonal functions (a modulated Fourier system). This system permits representation of features with fewer terms than are needed with Fourier transforms, and feature patterns having ploes can be obtained in the same manner as formants. Effectiveness of the proposed method is considered with respect to implementation on equipment which can use parallel processing in extraction.

## Discrimination of Vowels by Use of the Static Features of the Local Peaks in Frequency Spectra

**K. Kido, and T. Matsuoka**
*Tohoku University, Sendai, Japan*

*Reports of the Research Institute of Electrical Communication, Tohoku University 26:1-24, 1974*

The speech samples are frequency-analyzed by a filter bank composed of 29 single peak filters of Q=6. The center frequencies of the filters are every 1/6 octave from 250 Hz to 6300 Hz. The acoustical parameters P1, P2, Pe1, Pe2, and Pe3 are induced from the six largest local peaks of the frequency spectrum obtained by the analyses with the filter bank by applying the peak processing rules. The vowels samples uttered both in isolation and in continuation can be transformed almost perfectly into the phonemic symbols. The rate of the correct transformation of the vowels in spoken words into the phonemic symbols is about 80%. The speech samples are 5 Japanese vowels uttered by 31 male adults and twenty words uttered by 5 male adults.



## A Speech Processing System

**S. H. Saib**
*University of California, Los Angeles*

*Thesis. University Microfilms, Ann Arbor, Michigan. No. 75-2239, PC $11.00/MF $5.00*

The study was limited to English vowels spoken in sentences and concentrated on a search for those features which are speaker invariant. An automatic formant tracker was implemented to reduce the data rate from 10,000 to 1600 bytes per second and to provide an accurate indication of the formant frequencies and pitch frequency. The reduced formant and pitch data were then plotted versus time. Each speaker's characteristics were calculated by taking the sample average and sample variance of his formant frequencies. The normalized formant frequencies were used as features in a recognition algorithm applied to the original vowel data and to an independent set of vowel data. Significantly lower error rates are achieved for 13 speakers' vowels.

## Prosodic Aids to Speech Recognition: VI. Timing Cues to Linguistic Structure and Improved Computer Programs for Prosodic Analysis

Wayne A. Lea, and Dear R, Kloker
*Sperry UNIVAC, St. Paul, Minnesota*

*Report PX-11239, March 31, 1975 NTIS: AD-A010 221/0G4*
*PC $4.25/MF $2.25*

Descriptions of computer programs for detecting syntactic boundaries (BOUND 3) ahd locating stressed syllables (SJTRESS). Experiments were conducted on various timing cues that correlate with phonological and syntactic phrase boundaries. Further experiments are planned.



## k-nearest-neighbor Decision Rule Performance in a Speech Recognition System

G. M. White, and P. J. Fong
*Xerox Corporation, Palo Alto, California*

K-nearest-neighbor decision rules were tested on classification of vocal utterances, with k = 1 and k = 9. Accuracy was greater with k = 1.

## Digital Representation of Speech Signals

**R. W. Schafer, and L. R. Rabiner**
*Bell Laboratories, Murray Hill, N. J.*

*Proceedings of the IEEE 63:662-677, April 1975*

Several digital signal processing methods for representing speech are presented and critically discussed: simple waveform coding methods, time domain techniques; frequency domain representations; nonlinear or homorphic methods; and finally linear predictive coding techniques. 49 refs.



## A General Language-Operated Decision Implementation System (GLODIS): Its Application to Continuous-Speech Segmentation

**N. R. Dixon, and H. F. Silverman**
*IBM Thomas J. Watson Research Center, Yorktown Heights, New York*

*Report 5368 [1974]*

The general language-oriented decision implementation system (GLODIS) represents a flexible, operating-system approach to the generation and implementation of complex rules for decision making in pattern recognition. GLODIS is currently implemented as a phonemic-level segmenter for continuous speech. The segmenter is presented in sufficient detail for duplication by others, not only for speech segmentation but also for alternate applications. Performance data are given for a large amount (8 1/2 minutes) of continuous speech. Recent results from a total continuous speech recognition system, which incorporates the above, are also given.

## Automatic Phonemization in Practice

Goran Engstrom
*Research Group for Quantitative Linguistics, Stockholm*

*Statistical Methods in Linguistics 8:39-55, 1972*

The system, which checks trade mark words for the Swedish Patent Office, accepts orthographic input, constructs possible syllable representations, matches input syllables with syllables already stored in the machine, and determines whether or not the input word is similar to any other word currently being used as a trademark word. Consonant clusters are analyzed to establish possible syllable divisions. Each syllable is phonemized individually and, when the process is complete, the phonemic representations (which are, intentionally, only approximate) are synthesized into possible *phonograms* for the input word (indicating the range of pronunciations the word is likely to be given) and the matching process, not described in this paper, is begun.



## Computer Recognition of Handwritten Numerals by Polygonal Approximations

Theodosios Pavlidis, and Farhat Ali
*Computer Science Laboratory, Department of Electrical Engineering, Princeton University, Princeton, New Jersey*

*IEEE Transactions on Systems, Man, and Cybernetics 5:610-614, 1975*

The outlines of handwritten numerals are approximated by polygons enabling a simple evaluation of many intuitively descriptive features for numerals, for example, relative position and type of concave arcs. The method was tested on the Munson data (IEEE Data Base 1.2.2), and an overall error rate of 9.4 percent was achieved without any statistical optimization. A characteristic property of this approach is the existence of two steps: the first step (primitive feature generation) is primarily numerical, and the second step (feature selection and classification) makes extensive use of semantics.

## An Operations Research Approach to the Modeling and Analysis of Different Feature Sets Proposed for Human Perception of Capital Letters

**Charles DeWald**
*Operations Research Program, Department of Industrial Engineering, State University of New York, Buffalo 14214*

**Lewis H. Geyer**
*Department of Industrial Engineering, Northeastern University, Boston, Massachusetts*

*Computers and Operations Research 2:61-70, 1975*

A Markov chain feature transition model of capital letter recognition is presented for synthesizing empirically derived 26 by 26 capital letter *confusion matrices* (J T Townsend) The transition probabilities associated with the features in the model are used as the solution vector in an optimization problem, the objective being to minimize the sum of per cell squared differences between the empirical confusion matrix and the synthesized matrix Three proposed feature sets are used in conjunction with the model to synthesize three empirical matrices. Variants of the model are considered and results are tabulated and analyzed



## On Feature Extraction in Character Recognition (in German)

**R. Ott, and J. Schurmann**
*AEG Telefunken, Germany*

*Wissenschaftliche Berichte AEG-Telefunken 47:100-110, 1974*

A two stage system transforms a high number of original measurements into a lower number of pattern features before classifying them. The principal component approach is used The principal axis transformation is interpreted as a translation and rotation of the coordinate system in the original measurement space. Feature extraction is accomplished by truncating the transformed coordinate system. This approach is compared with the alternative of directly truncating the original coordinate system

## A Linguistic Pattern Recognition System

**D. H. Cooley**
*University of Utah, Salt Lake City*

*Thesis, University Microfilms, Ann Arbor, Michigan; No. 74-23100, PC $11.00/MF $5.00*

Linguistic rather than metric techniques are employed for pattern description and classification. All aspects of system design, encompassing both pre-processing and categorization functions have been investigated. The recognizer differs from those of previous linguistic systems in that it is trainable in much the same sense as are metric recognizers, an exact match or parse of an input string is not necessary for classification. Using Munson's numeric character data, a recognition of 76% was obtained. Of the 24% unrecognized, 10% of the total were what could be considered 'bad' numerals.



## Pattern Matching by Dynamic Programming (In Japanese)

**Y. Isomichi, and T. Ogawa**
*Chiba Institute of Technology, Japan*

*Journal of the Information Processing Society of Japan 16:15-22, January 1975*

In order to recognize handwritten characters a new type of pattern matching technique is used which depends on the hypothesis that patterns are a kind of elastic body. Within this hypothesis, distance between two patterns is defined as the minimum of sums of the internal energy of the elastic bodies and the mismatching quantities. Dynamic programming is used to accomplish the minimization. The patterns are presented on 20 by 20 lattice points.

## Choice of an Algorithm for the Recognition of Handwritten Characters (in Russian)

N. K. Miloslavskaya

*Otbor i Peredacha Informatsii 42:16-21, 1974*

After consideration of the principle difficulties encountered in machine recognition of handwritten characters, it is concluded that an algorithm employing image parameter normalization would be best. A formal analysis shows that the use of regular normalization permits the recognition of characters with different angles of orientation; the property of conservation of a certain stability in the horizontal dimensions of a character in a line makes possible the use of a simple decision rule based on comparison of the area of an image with a standard.



## On-line Character Recognition

A. C. Weaver
*University of Illinois*

*NTIS: PB-235 875/2, August 1974*
*PC $3.75/MF $2.25*

Discusses state-of-the-art in recognition of handwritten characters. A new recognition method is developed using a voltage gradient tablet for input and clever software for essential feature extraction. A simulation program is included as an appendix.

## Context in Word Recognition

A. R. Hanson, E. M. Riseman, and E. G. Fisher
*University of Massachusetts, Amherst*

*NTIS: AD-786 759/1, August 1974, PC $3.75/MC $2.25*

Relatively low character error rates can often lead to prohibitive levels of word error rates. Several techniques for integrating an independent contextual postprocessor (CPP) into a full classification system are examined. The CPP detects errors and is the control structure for directing additional processing for error correction.



## Character Reader

*Isotec Inc.*

*U.S. Patent 3784982, 8 January 1974. Commissioner of Patents, Washington, D. C. 20231 $0.50*

An electro-optical character reader for handwritten characters.

## Optical Characte1 Recognition

*Recognition Equipment Inc.*

*U.S. Patent 378491, 8 January 1974. Commissioner of Patents, Washington, D. C., 20231. $0.50*

This patent describes a system for normalizing signals produced by optically scanning different sizes and fonts of characters into a single format of signal for character recognition.



## Optical Character Recognition

*Recognition Equipment Inc.*

*U.S. Patent 3786416, 15 January 1974. Commissioner of Patents, Washington, D. C. 20231. $0.50*

Printed characters, superimposed on a contrasting center bar, are identified by scanning along vertically aligned, laterally spaced paths to generate signals dependent upon encountering character portions.

## Character Recognition

*Hitachi Ltd.*

*U.S. Patent 3803553, 9 April 1974. Commissioner of Patents, Washington, D. C., 20231, $0.50*

Characters are identified by pattern matching with standard characters. The system is particularly suitable for Chinese characters.



## A Method of Resolving Handwritten Chinese Characters and Its Computer Simulation (In Japanese)

S. Suzuki
*Shibaura Institute of Technology, Japan*

*Journal of the Information Processing Society of Japan 15:927-34, December 1974*

A spatial circuit is designed which is possessed of two faculties of resolving and contrasting pictures. The usefulness of the circuit in the recognition of handwritten Chinese characters is tested by computer simulation. A technique for converting the analog information-processing system into a digital information-processing system by means of the Fourier transformation for additive operators is explained.

## Recognition of Chinese Characters by Means of Hierarchical Pattern Representation

**H. Ogawa, and Y. Tezuka**
*Osaka University, Japan*

*Technology Reports of the Osaka University, Faculty of Engineering 24:603-615*
*October 1974*

Four kinds of local patterns are enough to represent a Chinese character. The proposed system consists of three kinds of sub-systems: front-end processor, B-pattern recognizer, and K-pattern recognizer. The front-end processor makes a thick character slender and extracts attention points (intersections and end points of strokes). The B-pattern recognizer is able to observe pre-patterns at attention points and to extract the B-pattern. Two kinds of measures were defined and utilized: the similarity measure showing a degree of similarity of sub-patterns and the maching measure showing a degree of possibility of a B-pattern. The K-pattern recognizer decides a K-pattern (a character) by using recognized B-patterns.



## A New Computer-based System for Chinese Character Generation

**Ryohei Kagaya**
*Project on Computational Analysis, National Inter-University Research Institute of Asian & African, Languages Cultures, 4-51-21 Nishigahara, Kitaku, Tokyo, 114 Japan*

**Yo Kobayashi**
*Section of Communication Research, Tokyo Metropolitan Institute of Gerontology, Japan*

*Computational Analyses of Asian & African Languages, 2:9-35, 1975*

A RDP-9 program translates identifying strings into graphic patterns. One part translates a unit representation into strokes; another treats spatial arrangement of constituent units; the third part displays the character.

## Character Set and Print Quality of Optical Character Recognition (OCR-A)

*American National Standards Institute, New York*

*X3.17-1974, 1975 $10.50*

Establishes a standard OCR character set and the basis for industry standards for paper and printing to be used in OCR systems, to aid in the implementation of such systems.



## Character Set for Hand Printing

*American National Standards Institute, New York*

*X3.45 - 1974, 1975 $5.75*

Prescribes shapes and sizes of handprinted characters to be used in optical character recognition systems and shapes of handprinted characters for man-to-man communication. This standard encompasses international requirements.

## Suffix Removal and Word Conflation

**J. L. Dawson**
*Literary and Linguistic Computing Centre, Cambridge University*

*Bulletin of the Association for Literary and Linguistic Computing 2, No. 3:33-46, 1974*

The system has a suffix removal program and a conflation program (which groups together words with lexically equivalent stems). The first program is based on an approach which requires no dictionary of word stems and is specifically designed to precede the second program.



## Rank distribution in text and speech
*Rangovye raspredeleniya v tekste i yazyke*

**M. V. Arapov, E. N. Ffimova, and Yu. A. Shrejder**
*Moscow, USSR*

*Nauchno-Tekhnicheskaya Informatsiya, Seriya 2, 1975, No. 2, 3-7*

Explication of Zipf's law.

## Directions in Artificial Intelligence: Natural Language Processing

**Ralph Grishman, editor**
*Computer Science Department, Courant Institute of Mathematical Sciences, New York University, 251 Mercer Street, New York 1001.*

*Report No. NSO-7, 1975*

Symposium. Modeling Dictionary Data, by Robert Simmons and Robert Amsler; Computerized Discovery of Semantic Word Classes in Scientific Fields, by Naomi Sager; The OWL Concept Hierarchy, by William Martin; and Design of the Underlying Structure for a Data Base Retrieval System, by Stanley Petrick; Discussion. See abstracts of contributions elsewhere on this fiche.



## English Lexical Collocations

**S. Jones**
*London School of Economics*

**J. McH. Sinclair**
*University of Birmingham, England*

*Cahiers de Lexicologie 24:15-61, 1974*

A study of two texts, a transcription of 135,000 words of spontaneous conversation and 12,000 words of written scientific text, suggest reasonable grounds for hypothesizing a lexical level of language organization independent from, but interacting with, both syntax and semantics. Grammatical (functor words) collocations differ statistically from lexical (contentives) collocations and are more likely to be position dependent while lexical collactions are position free. Association between lexical items is subject to grammatical influence (e.g. adjectives are consistently preceded by adverbs) and while the data suggest that grammatically free lexical sets exists, considerably more material will have to be analyzed for collocations in order to identify them.

## On the Meaning of Rank Distributions
*O smy·sle rangovykh raspredelenij*

**M. V. Arapov, E. N. Efimova, and Yu. A. Shrejder**
*Moscow, USSR*

*Nauchno-Tekhnicheskaya Informatsiya, Seriya 2, 1975, No. 1, 9-20*

Social organisms and rank distribution. Some examples. Attempt at probabilistic formalization. Another attempt. Alternative to the orthodox probabilistic approach. Some words about the aggregate situation with rank distribution. Again about the collective of N participants. Approximate description of the rank distribution in a closed text. Zipf's law and the family of rank distributions. The case of small text.



## The Concept of Lexical Structure of Text
*Ponyatie leksicheskoj struktury teksta*

**M. V. Arapov, and E. N. Efimova**
*Moscow, USSR*

*Nauchno-Tekhnicheskaya Informatsiya, Seriya 2, 1975, No. 6, 3-7*

An explication of Zipf's law.

## Computerized Discovery of Semantic Word Classes in Scientific Fields

Naomi Sager
*Linguistic String Project, New York University, 251 Mercer Street, New York 10012*

*Directions in Artificial Intelligence: Natural Language Processing, edited by Ralph Grishman. Report No. NSO-7, Courant Institute of Mathematical Sciences, 1975, pp. 27-48.*

The trick is to cluster words that are similar in their grammatical position, i.e., have the same word as their operator or argument. Clusters from 400 sentences of texts about digitalis are displayed. E.g., a class of motion verbs relate ion words to cell words. (The grammatical trees (or deep structures were made by human analysts, pending enrichment of the transformational component of the string parser.)



## Computer Recognition in English Word Senses

Edward F. Kelley
*Department of Electrical Engineering, Duke University, Durham, North Carolina*

Philip J. Stone
*Department of Social Relations, Harvard University, Cambridge, Massachusetts*

*North-Holland Linguistic Series, Vol. 13, 1975. American Elesevier, New York, N.Y. $17.50. Elsevier/Excerpta Medica/North-Holland, P O. Box 211 Amsterdam, The Netherlands Dfl. 42.00*

Developed from a large corpus of text representative of typical content analysis applications, the contextual search rules associated with each entry in the preprocessor dictionary (containing over 1000 entries) resolve text words into word senses. Large scale validation tests then prove that, relative to its specification of possible senses, the dictionary correctly resolves lexical ambiguity more than 90% of the time. This represents a major advance in the power and accuracy of automated content analysis procedures. The "disambiguation dictionary" has already been incorporated into the "General Inquirer".

## Automated Language Analysis

**Sally Yeates Sedelow**
*University of Kansas, Lawrence*

*NTIS:AD/A-002 463/8GA*

The report includes: 1) A description of the editing of a computer-accessible version of Roget's International Thesaurus; 2) A discussion of mathematical approaches to the modelling of Thesauri, with Roget's serving as an example; 3) Graph Theory applications to the study of the structure of Roget's.



## A Bilingual Lexicon of 1001 Words from 24 Chapters of the Revised Statutes of Canada - Un lexique Bilingue de 1001 mots extraits de 24 chapitres des statuts revises du Canada

**V. Bergeron, and D. Burke**
*Faculte de Droit, Section de Droit Civil, Universite d'Ottawa, Ontario, Canada*

*Report*

English-French micro-dictionary with illustrative citations, produced from computer-stored bilingual texts. The JURIVOC system is conversational: the system finds parallel sentences in the two languages which contain a given term, and presents them via a CRT terminal to a linguist-monitor who selects from them and prunes the contexts by keyboard manipulation.

## Modeling Dictionary Data

**Robert F. Simmons, and Robert A. Amsler**
*Department of Computer Sciences, University of Texas, Austin 78712*

*Directions in Artificial Intelligence: Natural Language Processing, edited by Ralph Grishman, Report No. NSO-7, Courant Institute of Mathematical Sciences, 1975, pp. 1-26.*

Forms and structures of definitions (of verbs) in Merriam-Webster's dictionaries are presented to derive models of sense-selection contexts, sense meanings, and hierarchical relations among verbs. The sense-meaning model is presented as a case-role semantics accompanied by time-ordered sets of assertions marked for truth value. Systematic extraction of these types of models from dictionary data is argued to be an encouraging line of research.

GRAMMAR: MORPHOLOGY

## Synthesis of Russian Nominal Word-forms by Means of a Computer

**T. I. Korovina**
*USSR*

*Nauchno-Tekhnischeskaya Informatsivd, Seriya 2, No. 3:22-29, 1975*

A description of an algorithm for the synthesis of Russian nominal word-forms on the basis of the morphology model developed by Es'kova, Mel chuk and Sannikov (1971). The programming language, ASTRA, used to encode the algorithm is described in brief. Specimens of word-forms from BESM-6 computer printout are appended.

## A Best-First Parser

**William H. Paxton**
*Artificial Intelligence Center, Stanford Research Institute, Menlo Park, Calif*

*IEEE Transactions on Acoustics, Speech, and Signal Processing 23:426-432, 1975*

The Parser uses a best-first strategy in which alternative paths are assigned priorities and paths are suspended as long as there is a higher priority alternative. There are 4 types of steps in a parse: 1) Syntactic--selection of particular grammatical constructions, 2) Lexical - choice of a particular word from a particular class, 3) Word Verification - proposed words are matched against acoustic data, and 4) Interparse Cooperation - cooperation among competing parses. Priorities are assigned at each step along a path. The system extends the path with the highest cumulative priority (1000 times the product of step priorities to that point). Experimental results are given.



## Syntactic Analysis in R.E.L. English

**Bozena Henisz Dostert, and Fredrick Burtis Thompson**
*California Institute of Technology, Pasadena*

*Statistical Methods in Linguistics 8:5-38, 1972*

REL(Rapidly Extensible Language) English has been made more powerful with the addition of procedures for handling case (Fillmore) and pronouns. Thus verbs are analyzed as propositions expressing relations between nouns. Using a modified form of the Martin Kay parser, case labels become incorporated into the arc labels of the parsing graph. Pronouns and quantifiers are variables which must remain an active part of analysis as long as they are free, with their meaning being determined at the point in analysis when they can be bound. A list of all free variables in a phrase and pointers to each occurrence of each variable is included in the arc labels in the parsing graph.

## A System for Automatic Syntactic Analysis of Russian Texts

G. P. Aleksandrova, G. G. Belongor, A. P. Novoseelov, and E. I. Stogov
*USSR*

*Nauchno-Tekhnicheskaya Informatsiya, Seriya 2, No. 3:30-35, 1975*

No restrictions are imposed on the structure and the word stock of the texts being analyzed, which is achieved by means of a procedure of the automatic assignment of the grammatical features to the 'new' words. In scientific or technical texts, the system provides for the identification of some 85% of relations between words. With simpler texts (abstracts) 93% of the identified relations are correct.



## Automatic Generation of English Sentences
*Automatische Erzeugung englischer Saetze*

K. Detering, H. Pilch, and D. Clement
*Albert-Ludwigs-Universitaet, Freiburg, Germany*

*Janua Linguarum, Series Practica, No. 170; Mouton, The Hague, 1973*

A purely syntactic combinatory synthesizer of grammatically correct English sentences is based on the hypothesis that the synthesis process is the inverse of the analysis process. The formalism is sufficiently general to describe other languages. A chapter deals with its limits (e.g. sentence length and complexity), marginally acceptable utterances, rule collisions. 70 examples of output are reproduced.

## Do Machines Understand More than They Did?

**Yorick Wilks**
*Artificial Intelligence Laboratory, Stanford University*

*Nature 252:275-278, 1974*

Transformational generative theory has three defects: 1) the generation of sentences is not a significant demonstration of human understanding, 2) the competence-performance distinction isolates linguistics from tests of systems of rules, 3) it has little room for inferences. Winograd's SHRDLU system is vulnerable to these criticisms: 1) the linguistic system is conservative, 2) its semantics is tied to a simple referential world, and 3) and it is strongly deductive and logically closed. Current fashion is strongly linked to Minsky's frame paradigm. Charniak's demon theory is superficial in that his demons are in item-to-item correspondence with English sentences. Conceptual Dependency theory (Schank) and Preference Semantics (Wilks) provide a deeper view by the reduction of concepts to primitives. Current points of contention: 1) do we make and retain massive forward inferences or only generate deep inferences when shallow ones fail, 2) do we decouple syntax and semantics or achieve the results of syntactic analysis by a sufficiently powerful semantic analyzer?



## Semantic Approaches for Models of Automatic Analysis of Natural Languages
*Approches semantiques pour les modeles d'analyse automatique de langues naturelles*

**Ch. Boitet, and J. Chauche**
*Groupe d'Etudes pour la Traduction Automatique, Institut de Recherches en Mathematiques Avancees, Universite Scientifique et Medicale de Grenoble, B. P. No 53 - 38041 Grenoble Cedex, France*

*Mimeographed 1975*

Analytic review of models and systems for passing from text to deep structure or representation of meaning. Levels of representation. Coding (string, tree graph), functions, algorithms. Criteria of power, simulation, complexity, adequacy. Systems: TITUS II, CETA,GETA, Mel'chuk, Simmons, Wilks, TLC, Winograd, Schank.

## Computational Understanding: Analysis of Sentences and Context

Christopher Kevin Riesbeck
*Department of Computer Science, Stanford University, Stanford, California 94305*

*Report Nos. STAN-CS-74-437, AIM-238; NTIS: AD/A-005 040/1GA*
*PC $7.50/MF $2.25*

The construction of this system for the analysis of written texts was guided by four assumptions: 1) The primary goal of comprehension is always to find meanings as soon as possible. Other tasks, such as discovering the syntactic relationships, are performed only when essential to decisions about meaning. 2) An attempt is made to understand each word as soon as it is read. 3) Comprehension means not only understanding what has been seen but also predicting what is likely to be seen next. 4) The words of a text provide the cues for finding the information necessary for comprehending that text.



## The SRI Speech Understanding System

Donald E. Walker
*Artificial Intelligence Center, Stanford Research Institute, Menlo Park, Calif.*

*IEEE Transactions On Acoustics, Speech, and Signal Processing 23:397-416, 1975*

In the SRI system, knowledge from various sources (grammar and semantics, world model, user and discourse models, acoustic-phonetic data) is coordinated by a "best-first" parser to predict the sequence of words in an utterance, and word functions--programs that represent acoustic characteristics of a word--are used to test the predictions. Data on the system's performance are presented and discussed.

## SAM--A Story Understander

**Roger Schank, and the Yale A.I. Project**
*Department of Computer Science, Yale University, New Haven, Connecticut.*

*Research Report 43, August 1975*

A script is a causally organized conceptual structure representing actions performed in stereotyped situations (e.g. eating in a restaurant). SAM (Script Applier Mechanism) understands stories that rely heavily on scripts. It can produce a short or a long paraphrase of the input story, a summary of the story, and it has a question answering program and a program to translate stories into Chinese. Each script is organized around a goal (such as INGEST for eating in a restaurant), which usually implies mutual obligations among participants in the script, and consists of tracks (eating at McDonalds, eating at an expensive restaurant, etc.) which consist of scenes which consist of subscenes.



## An Environment and System for Machine Understanding of Connected Speech

**L. D. Erman**
*Stanford University*

*Thesis. University Microfilms, Ann Arbor, Michigan. No. 74-27012*
*PC $11.00/MF $5.00*

The HEARSAY system uses syntactic, semantic, and contextual information, as well as the more traditional domains of acoustic-phonetic, phonological, and lexical knowledge, in order to recognize and understand utterances.

# Computer Assisted Application System

**Martin Mikelsons**
*IBM Thomas J. Watson Research Center, Yorktown Heights, New York*

*Report 5387*

A system is being developed to bridge the gap between an application program and a user inexperienced in the ways of computers. The user explores the characteristics of the available programs by a natural language dialogue with the system. The dialogue is supported by a knowledge base covering both the program semantics and the application domain. This paper addresses the problems of representation and inference involved.

# Semantic and Argumentative Text Description: A Contribution to the Simulation of Speech Communication

*Semantisches und argumentative Textdeskription: Ein Beitrag zur Simulation sprachlicher Kommunikation*

**Winfried Lenders**
*Institut fuer Kommunikationsforschung und Phonetik, Universitaet Bonn, Germany*

*Helmut Buske Verlag, Hamburg, 1975*
*ISBN 3-87118-199-4*

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## Speech Understanding Systems: Quarterly Progress Report No. 1, 1 Nov 74 - 1 Feb 75

William A. Woods, Richard M. Schwartz, John W. Klovstad, Craig C. Cook, and Jared J. Wolf
*Bolt Beranek and Newman Inc., 50 Moulton Street, Cambridge, Massachusetts 02138*

*Report No. 3018, 1975; AD-A007 586/1GA*
*PC $4.75; MF $2.25*

Acoustic phonetics, lexical retrieval, lexical verification, and natural-language syntax, semantics, and pragmatics. Part 1: Brief survey of progress in the individual components of the project. Part 2: Technical notes containing detailed specifications of experiments performed, programs implemented, design studies, and where appropriate supporting data and appendices.



## The Simple Simons: Three Pedagogical Examples of the Use of ENT 2212

David B. Benson, and Thomas R. West
*Computer Science Department, Washington STate University, Pullman 99163*

*Report No. CS-74-015*

Simple Simon 1 is a completely trivial extension to Ent 2210 illustrating the basic semantic and extension capabilities of Ent, Definition; illustration; reformulation as Simple Simon 1.5 with equal "understanding" of English. Simple Simon 2 uses subset and set membership facilities and recursion to demonstrate an elementary method of distinguishing "fact" from "possibility". Simple Simon 3 illustrates a method of treating pronouns and anaphoric references; time is handled as a relation. Use of extension capabilities to define numerous semantic subroutines and to establish a good notation for association entry and retrieval.

## Understanding Understanding Systems

**David Klahr**
*Carnegie-Mellon University*

*Lee W. Gregg, Editor, Knowledge and Cognition, Lawrence Erlbaum Associates, Inc., 295-300, 1974*

This is a discussion of MERLIN (Moore and Newell) and HEARSAY (Reddy and Newell)--both papers are abstracted elsewhere on this fiche. Human learning of language and of knowledge in general takes place in situations where complex error correction (from adults) is available. Both Merlin and Hearsay are silent on the issue of the source of knowledge. This raises the following issue: Can a system that has not self-constructed most of its knowledge--through a cycle of assimilation and accommodation--ever manifest deep understanding? Both Merlin and Hearsay deal with second-hand, preprocessed knowledge.



## Knowledge and Its Representation in a Speech Understanding System

**Raj Reddy, and Allen Newell**
*Carnegie-Mellon University*

*Lee W. Gregg, Editor, Knowledge and Cognition, Lawrence Erlbaum Associates, Inc., 253-285, 1974*

HEARSAY operates in the microworld of voice-chess. Knowledge from acoustic, syntactic and semantic sources is used to generate hypotheses about the incoming speech signal, thereby restricting the search space. Given that a word such as "captures" or "takes" appears in the partial sentence hypothesis, this knowledge can be used to restrict the search to the capture moves in that board position. The grammar is context free. The parser is a modified top-down parser and uses antiproductions (giving all contexts for every symbol appearing in the grammar) in parsing backwards and forwards. Phonemic description is used for mapping words in the 31 item lexicon onto segments of the incoming utterance. At the phonemic level, characteristics of the phonemes, rules for predicting missing and extra segments in relaxed speech, juncture rules and rules that distinguish between pairs of phonemes, are available to the system. Knowledge of allophonic variability and speaker variability are also used. A detailed discussion of one example ("Bishop to Queen knight three") is given.

## A Framework for Representing Knowledge

**Marvin Minsky**
*Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge 02139*

*Report AI-M-306, June 1974; NTIS: AD-A011 168/2GA*
*PC $4.75/MF $2.25*

The theory combines classical and modern concepts from psychology, linguistics, and AI. In a new situation one selects from memory a structure called a frame: a remembered framework to be adapted to fit reality by changing details as necessary, and a data-structure for representing a stereotyped situation. Attached to each frame are several kinds of information - how to use the frame, what one can expect to happen next, and what to do if these expectations are not confirmed. The report discusses collections of related frames that are linked together into frame systems.



## Frames, Planes and Nets: A Synthesis

**Greg W. Scragg**
*Istituto per gli Studi Semantici e Cognitivi, Castagnola, Switzerland*

*Working Papers 19, 1975*

By incorporating the notion of frames into semantic nets it becomes possible to establish a level of representation for a concept intermediate between the nodes adjacent to the concept node and the entire net. Weak bi-directional links are formed between a *key node* and the nodes in the *plane* for key node. The plane is a frame-like unit Each concept node is the key word of some plane and each plane is exactly the same as the list of planes in which a node appears. As a node is activated, so is its associated frame. A short first-in first-out list of active planes is established as a basis for context maintenance, resolution of word ambiguity, and other inferential processes.

## A Memory-Process Model of Symbolic Assimilation

**W. C. Mann**
*Carnegie-Mellon University*

*NTIS: AD/A-004 331/5, April 1974, 291p,*
*PC $8.75/MF $2.25*

The assimilation problem concerns making knowledge to make available information useful. Research conducted on this problem has resulted in a model of human short term memory and an effective collection of new general methods for information science. The program manipulates knowledge and experience represented as labelled directed graphs.



## Conceptual Memory: A Theory and Computer Program for Processing the Meaning Content of Natural Language Utterances

**C. J. Rieger**
*Department of Computer Sciences, Stanford University*

*Report Nos. STAN-CS-74-714, AIM-233, July 1974; NTIS: AD/A-000 086/9, 412p*
*PC $10.50/MF $2.25*

Humans perform vast quantities of spontaneous, subconscious computation in order to understand even the simplest language utterances. The computation is principally meaning-based, with syntax and traditional semantics playing insignificant roles. This thesis supports this conjecture by synthesis of a theory and computer program which account for many aspects of language behavior in humans. It is a theory of language and memory.

## A Brief on Case

**Eugene Charniak**
*Istituto per gli Studi Semantici e Cognitivi, 6976 Castagnola, Switzerland*

*Working Papers 22, 1975*

Cases are the few ways arguments can be related to a predicate. Linguistic benefits (meaning can be factored into meaning of predicate and of case; determining what arguments may appear in surface structure; ordering arguments) rarely appear in AI; the reasons are notational problems, lack of semantic definitions of cases, and representations too far from surface structure. Selection restrictions can be stated without cases so can implied but unstated arguments. In AI, the main benefit of case is facilitation of inferences; but often a change of notation gains the same inferences without case. Case notation is popular because it suits networks, whereas positional notation suits predicate formulas; but current AI systems use the notation without its theoretical content.



## A Structure for Actions

**Greg W. Scragg**
*Istituto per gli Studi Semantici e Cognitivi, Castagnola, Switzerland*

*Working Paper 20, 1975*

Knowledge of actions is used in AI systems for performance, planning, question understanding, cause-and-effect representation, and beliefs. KOP (Knowledge of Procedure) nets are intended to be psychologically reasonable and a suitable basis for all these applications, blending easily with static representations for world knowledge. KOP nets contain three types of events: GOAL, ROTE, and WAIT. They are tied together in a structure containing time orderings, reasons, major steps, results, methods, and static information. Both task and motive-directed processors are envisaged to account for the difference between actions described in English with different adverbs.

## The OWL Concept Hierarchy

**William Martin**
*Massachusetts Institute of Technology, Cambridge 02139*

*Directions in Artificial Intelligence: Natural Language Processing, edited by Ralph Grishman. Report No. NSO-7, Courant Institute of Mathematical Sciences, 1975, pp. 49-59.*

The right representation is important in eliminating complexity so that very large programs can be made. The representation communicates the way a field is organized. Multiple representations are needed for different processes, perhaps at different levels, even if one is canonical. No one set of primitives provides a decent way to think about the world. Pattern matching is more important than logic, deduction, or procedure execution; long chains of reasoning fail in AI, but finding that a problem belongs to a class with known solution type succeeds. The whole problem of getting knowledge into a canonical representation will be done by "volunteers" if a good form is proposed. OWL uses specification and semantic cases; examples.



## Sublanguage Grammar in Science Information Processing

**Naomi Sager**
*Linguistic String Project, New York University*

*Journal of the American Society for Information Science 26:10-16, 1975*

The literature of a science subfield has characteristic restrictions on language usage which can be used to develop information formats for text sentences in the subfield. The text grammar for the subfield of pharmacology we have investigated has four levels: 1) Start at the bottom of the parses and collect nouns into classes on the basis of co-occurrence with verbs and verbs into classes on the basis of co-occurrence with nouns. At the bottom level a verb with noun subject and noun object is an elementary sentence. Elementary sentences may have operators on them and these operators yield 3 more levels. 2) Quantity words as operators. 3) Sentence connecting verbs. 4) Verbs with human subjects which express the scientist's relation to the events.

## A Program for Generating Reports on the Status and History of Stochastically Modifiable Semantic Models of Arbitrary Universes

Sheldon Klein, John D. Oakley, David J. Shurbalie, and Robert A. Ziesmer
*Computer Sciences Department, University of Wisconsin, Madison*

*Statistical Methods in Linguistics 8:64-93, 1972*

A three level model of language which has an affinity to Lamb's Stratificational Grammar (though transformations are used in the system), is used to write a story. The input data consists of: 1) a list of participants (e.g. George, cigars, party, George's apartment, etc.), 2) a list of relations (e.g. in, dislikes, jealous, etc.), 3) a statement of classes (men, rooms, etc.), 4) the attributes of the human participants (bald, Italian, sexy, etc.), 5) propositions (triples) about the human participants (George likes nightclub, George is in computing, etc.), and 6) a set of probalistic rules for generating plot episodes, such as inviting people a party, getting drunk, etc. The first five lists define initial conditions and the list of rules operates on these conditions to produce a list of episodes in the story.



## A Study of the Paragraph Structure

Adam J. Szamser
*Computer Science Division, National Physical Laboratory, Teddington, England*

*Statistical Methods in Linguistics 1973:79-90*

A study of 45 American and British scientific articles comprising 1532 paragraphs and 7453 sentences showed a mean of 4.87 sentences per paragraph with a standard deviation of 2.18. This lends weight to the assumption that the number of semantic units (assumed to be sentences) in a paragraph corresponds to the Miller-Yngve limit (7, plus or minus 2) of human short term memory. An algorithm for dividing a continuous text into paragraphs consists of two runs. On the first the text is scanned for links (indicative of semantic relationships) by using short lists of appropriate words and phrases. The second scan searches for fluctuating patterns of repeated words. The algorithm was tested by machine for some procedures with others being carefully hand simulated. The test was fairly, but not completely, successful.

## Computer Generation of Natural Language from a Deep Conceptual Base

**Neil M. Goldman**
*Department of Computer Science, Stanford University*

*Report Nos. STAN-CS-74-761, AIM-247; NTIS: AD/A-005 041/9, January 1974, 321p, PC $9.25/MF $2.25*

The currently implemented system generates English sentences from Conceptual Dependency network which are unambiguous, language-free representations of meaning. The system is designed to be task independent and thus capable of providing the language generation mechanism for such diverse problem areas as question answering, machine translation, and interviewing.

LINGUISTICS

## Chinese Linguistics and the Computer

**William S-Y. Wang, Stephen W. Chan Chan, and Benjamin K. T'sou**
*University of California, Berkeley*

*Linguistics 118:89-117, 1973*

Phonology and contrastive grammatical studies. The former is concerned with the study of general linguistic processes of sound change utilizing data on modern and ancient Chinese dialects. Phonological rule testing and frequency counts are reported and discussed. The application of the computer to automatic parsing of Chinese and to Chinese-English MT (within a generative framework, interlingual processes being on a deep structural level) is described in detail as well as problems of input/output and quantitative studies of language. 65 item bibliography.

## On the Syntactic Structures of Unrestricted Grammars: I. Generative Grammars and Phrase Structure Grammars

H. William Buttelmann
*Department of Computer and Information Science, Ohio State University, Columbus 43210*

*Information and Control 29:29-80, 1975*

Structural equivalence is an equivalence relation over the derivations of a grammar. For unrestricted grammars, two derivations are structurally equivalent if they have the same syntactic structure. A proof for the uniqueness of the rightmost derivation of an equivalence class is given. Derivation structures and phrase structures are nonisomorphic concepts. There is a natural correspondence between generative productions and phrase structure productions, and by extension, between the two kinds of grammars and between their derivations. But the structure does not necessarily preserve structural equivalence in either direction. However, if the correspondence from the productions of a phrase structure grammar to the productions of a generative grammar is a bijection, then structural equivalence on the generative derivations refines the image under the correspondence of structural equivalence on the phrase structure derivations.



## On the Syntactic Structures of Unrestricted Grammars: II. Automata

H. William Buttelmann
*Department of Computer and Information Science, Ohio State University, Columbus 43210*

*Information and Control 29:81-101, 1975*

We define a generalization of the finite state acceptors for derivation st uctures and for phrase structures. Corresponding to the Chomsky hierarchy of grammars, there is a hierarchy of acceptors, and for both kinds of structures, the type 2 acceptors are tree automata, for $i = 0,1,2,3$, the sets of structures recognized by the type $i$ acceptors are just the sets of projections of the structures of the type $i$ grammars, and the languages of the type $i$ acceptors are just the type $i$ languages. Finally, we prove that the set of syntactic structures of recursively enumerable languages is recursive.

## Context-Free Grammar Forms

**Armin Cremers, and Seymour Ginsberg**
*University of Southern California, Los Angeles*

*Journal of Computer and System Sciences 11:86-117, 1975*

A "grammar form" provides the general structure of the productions in the grammars to be defined and an "interpretation" yields a specific grammar. A family of grammars is formed by considering all interpretations of a form. Necessary and sufficient conditions on a context-free grammar form are given in order for it to yield, respectively, exactly the finite languages, the regular sets, the linear context-free languages, and all the context-free languages. Each context-free grammar form can be replaced by another, yielding the same family of languages, in which the underlying grammar is sequential. The family of languages obtained from each context-free grammar form is a full principal semi-AFL.



## The Concept of a Linguistic Variable and its Application to Approximate Reasoning--III

**L. A. Zadeh**
*Computer Sciences Division, Department of Engineering and Computer Sciences, and the Electronics Research Laboratory, University of California, Berkeley*

*Information Sciences 9:43-80, 1975*

The concept of a linguistic variable provides a basis for defining linguistic probabilities (e.g. *likely*, *very likely*, etc.) and, in conjunction with the extension principle, may be applied to the computation of linear forms in such probabilities. Approximate reasoning requires a so-called *compositional rule of inference* of which *modus ponens* forms a special case. The paper concludes with a discussion of fuzzy theorems, exemplified by a fuzzy theorem in geometry, and a discussion of graphical representation by fuzzy flowcharts.

## Relational Production Systems

Steven A. Vere
*Department of Information Engineering, University of Illinois at Chicago Circle, Chicago 60680*

*MDC 1.1.5, September 1975*

A relational production system (rps) is a generalization of type 0 string grammars to the predicate calculus. It consists of a "situation", which is a conjunction of ground literals, and an unordered set of relational productions which cause the replacement of a subset of literals by other literals. Rps is a formal information processing model developed to support artificial intelligence studies of knowledge representation and inductive learning. It offers a unifying representation for problem solving systems, web grammars, and string grammars. It embodies much of current empirical systems and maintains a mathematical precision and simplicity that allow proof of useful results. Simple examples; composition theorem. Without a sponge-like component in the antecedent of a production, composition of two arbitrary productions is in general impossible; this result casts doubt on the STRIPS triangle table technique.



## Tree Grammars: I. A Formalism for Syntactic Transformation in Natural Languages

**A. V. Gladkij, and I. A. Mel'cuk**

*Linguistics 150: 47-82, April 15, 1975*

Suppose that semantic structure takes the form of a complex graph. The grammar derives at least one deep syntactic structure (DSS) for a given semantic structure. That DSS is mapped onto other (ideally, all) DSS's and each DSS is mapped onto a surface syntactic structure. A syntactic tree grammar operates on trees whose nodes are unlabeled and whose branches are labeled with syntactic relations. There is a hierarchy of syntactic tree grammars: 1. Arbitrary syntactic tree grammars. 2. Expansive tree grammars. 3. Minimal tree grammars. 4. Context free tree grammars. A grammar lower on the hierarchy is a special case of a grammar higher in the hierarchy. Three elementary transformations on trees are of interest: 1. Splitting a node. 2. Transposing a node. 3. Merging nodes. By restricting the number of branches of a given label going down from any node a regular syntactic tree grammar is derived from a syntactic tree grammar. A regular lexical-syntactic tree grammar operates on regular trees whose nodes are labeled with symbols from a deep lexicon.

## SMIL 1975

**Hans Karlgren, editor**
*Sprakforlaget Skriptor, Box 104 65 Stockholm 15, Sweden*

*SMIL: Statistical Methods in Linguistics, 1975. ISSN 0039-0437.*

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LINGUISTICS: HISTORICAL

## Mechanization of Cognate Recognition in Comparative Linguistics

**Fred J. Damerau**
*IBM Research Center, Yorktown Heights, New York 10598*

*Linguistics 148:5-29, 1975*

The cognate recognition program consists of a basic decomposition algorithm, modified in the case of distantly related languages to allow a single unique correspondence per decomposition, with word pairs showing ambiguous decompositions discarded. The algorithm is run on the word list plus its offsets in steps of ten (to check on chance matches, independent of word meanings), with a phonetic plausibility rating for the resulting final set of correspondences. Appendices give some results of the program for a list of German and English words and for pairwise comparisons among the following five languages: English, German, French, Rumanian, and Russian.

## On the Storage Economy of Inferential ,Question-Answering Systems

**Judea Pearl**
*School of Engineering and Applied Science, University of California, Los Angeles*

*IEEE Transactions of Systems, Math and Cybernetics 5:595-602, November 1975*

Absolute bounds are established on the amount of memory savings that is achievable with a specified error level for certain types of question-answering systems. Question-answering systems are treated as communication channels carrying information concerning the acceptable answers to an admissible set of queries. Shannon's rate-distortion theory is used to calculate bounds on the memory required for several question-answering tasks. For data retrieval pattern classification, and position-matching systems, it was found that only small memory gains could be materialized from error tolerance while in pair-ordering tasks more significant memory savings could be accomplished if small error rates are tolerated.



## Induction of concepts in the predicate calculus

**Steven A. Vere**
*Department of Information Engineering, University of Illinois at Chicago Circle, Chicago 60680*

*Mimeographed, 1975*

Positive and negative instances of a concept are assumed to be described by a conjunction of literals in the predicate calculus, with terms limited to constants and universally quantified variables. A graph representation of conjunction of literals, called a "product graph" is introduced. It is desirable to merge positive instances by generalization, while maintaining discrimination against negative instances. This is accomplished by an induction procedure which operates on the product graph form of these positive and negative instances. The correctness of the procedure is proven, together with several related results of direct practical significance. The goal is a formal model for the inductive processes used in artificial intelligence.

## Relation Representation by Tables and by Functions

**Reiner Durchholz**
*Gesellschaft fuer Mathematik und Datenverarbeitung, St. Augustin, Germany*

*Information Systems 1:91-96, 1975*

Using the point set representation of a relation as a *tertium quid* between a network representation and a table representation, it can be seen that the two forms (table and network) are interconvertible. Functional dependence, which allows reduction of the dimensionality of the attribute space in point set representation, is more important for types of relations than for single relations because types are likely to remain invariant over long term use of the data base.



## Hierarchies of Data Base Languages: An Example

**Klaus-Dieter Kraegeloh, and Peter C. Lockemann**
*Fakultaet fuer Informatik, Universitaet Karlsruhe, Germany*

*Information Systems 1:79-90, 1975*

The notion of a hierarchy of abstract machines leads to a data base interface organized on four levels: 1) At the zero order is an abstract machine which determines which among available software packages is the most suitable. (Since hardware and software were already determined for us, the zero order consists of mappings from 1st order to Extended ALGOL). 2) The first order is a set theoretic machine with recursive control which does the data manipulation. 3) The set theoretic machine is mapped into a natural language machine (German) whose grammatical categories are essentially semantic and, 4) the third order machine is specification of the NL for a particular application (in this case, Pharmacology).

## Database - The Ideas Behind the Ideas

**K. A. Robinson**
*Surrey County Council, Kingston-upon-Thames*

*Computer Journal 18:7-11, February 1975*

A data base is a model of the real world. The programs which update and retrieve the data are themselves models of events in the real world. Maintenance of programs and systems is much easier if that part of the world being modelled by the programs and data is intuitively obvious from the data descriptions and the application procedure descriptions. Three approaches to data base management (CODASYL DBTG, GUIDE-SHARE and Relational Databases) are considered with regard to the facilities they provide for modelling the real world and the mechanisms by which they physically support these facilities.



## Application Possibilities for Petri Nets in Management Information Systems: I. Applications in Data Bank Systems

*Anwendunsmoeglichkeiten von Petrinetzen in Management Informationssystemen: I. Anwendungen in Datenbanksystemen*

**Karl Baku**
*Universitaet Stuttgart, Germany*

*Diploma thesis, June 1975*

The form of Petri nets (Mathematical Foundations of Computer Science, High Tatra, 1973); processes; previous applications; data-bank problems: feature analysis, relational systems, DIAM; concurrent processes.

## Formal Description of a Result-oriented Data Manipulation Language
*Formale Beschreibung einer resultatorientierten Datenhandhabungssprache*

**Frank Steyer**
*Institut fuer Informatik, Universitaet Stuttgart, Germany*

*Student paper, June 1974*

The method applied is the Vienna Definition Language (P. Wegner); data representation, abstract syntax of the data manipulation language, and interpretation of linguistic expressions with the help of the data are described.



## The design of a Semantically Directed Vision Processor (Revised and Updated).

**Allen R. Hanson, and Edward M. Riseman**
*Department of Computer and Information Science, University of Massachusetts, Amherst*

*Report COINS-TR-75C-1, February 1975; NTIS: AD-A010 150/1GA*
*PC $4.25/MF $2.25*

The system will carry out model-directed analysis of outdoor scenes by applying semantic knowledge at an early stage of processing. The goal is to quickly and flexibly interface low-level visual features (e.g. edge detectors, texture and color analyses) and high-level conceptual knowledge (e.g. trees stem from the ground, general knowledge associated with road scenes, etc.) in the perception of complex images. A "processing cone" rapidly extracts visual features and consists of parallel spatial arrays of micro-computing elements, each of which operates on a local window to reduce the data layer by layer. Information flows up, down, and laterally in the cone via a sequence of local parallel operations. Routines for detecting objects will examine the data at the top of the cone and will selectively analyze the lower level mass of data. Rough confidences of the presence of objects in various regions will be passed to the model builder.

## Some Considerations in a Model Building System for Scene Analysis

**Daniel H. Fishman, and Allen R. Hanson**
*Report COINS-TR-75C-2, March 1975 NTIS: AD-A010 149/3GA*
*PC $3.75/MF $2.25*

The goal of VISIONS is to build a semantic 3-dimensional model from a 2-dimensional digitized scene. The model must use information ranging from processed visual data to highly structured semantic information embodied in context frames. The modular subsystems that process this information interact through an executive responsible for model construction. A simplified scenario of model construction demonstrates how the system might work.



## Pattern Recognition (A Bibliography with Abstracts)

**David W. Grooms**
*National Technical Information Service, Springfield, Virginia*

*NTIS/PS-75/514/0GA, June, 1975*
*PC $25.00/MF $25.00*

The bibliography cites research in the areas of pattern recognition, character recognition, and image processing. It includes research in processing color pictures, coding methods, image enhancement and restoration, and feature extraction; theory and applications are also covered Covers 1964 to June 75. 184 abstracts.

## Blueprint of an Obstetric Information System

**E. R. Gabrieli**
*Clinical Information Center, State University of New York, Buffalo 14214*

*Journal of Clinical Computing 3:382-406, 1974*

A machine-aided obstetrics information system should provide: 1) short-range retrievability of clinical data for use in case management, 2) cumulative patient records, 3) statistical reports for various administrative, planning, epidemiologic purposes, 4) automated monitoring of obstetric care for quality assessment, and, most significantly, 5) an *artificial obstetric memory*. The machine should have the ability to retrieve "similar cases", so that the clinician can consult the pooled, shared experience in the field before making his diagnostic-theraputic decisions. This requires a stable, controlled obstetric vocabulary which would be used for the storage of information in a semantic network.



## TOS: A Text organizing System. Volume I.

**Kemal Koymen**
*Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia*

*NTIS: AD-783 986/3, May 1973*
*PC $8.50/MF $2.25*

The system automatically indexes, classifies and reposits text items, which may be any aggregates of information in English on a computer-readable media in a standard format.

## TOS: A Text Organizing System. Volume II, Appendixes, A-C.

**Kemal Koymen**
*Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia*

*NTIS: AD-785 187/6, August 1974,*
*PC $11.25/MF $2.25*

Appendices of Volume I (above) including a user's manual, a programmer guide and program descriptions and flowcharts.

## Information for Action: From Knowledge to Wisdom

**Manfred Kochen; editor**
*Department of Psychiatry, Mental Health Research Institute, University of Michigan, Ann Arbor 48102*

*Academic Press, New York, 1975*
*ISBN 0-12-417950-9* *$12.50*

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*Howard J. Hilton*

## Essays in the Analysis of Archeological Discourse
*Essais d'analyse du discours archeologique*

Jean-Claude Gardin, and Marie-Salome Lagrange
*Centre de Recherches Archeologiques, Centre National de la Recherche Scientifique, 27, Rue Paul Bert, F 94200 Ivry-sur-Seine, France*

*Notes et Monographies Techniques No 7, 1975. ISSN 0301-553 X.*

Reconstruction of the semantics and logic in two monographs; how the archeologist arrives at a description of an object. The exploitation of computers for the ends of science evidently requires that the framework of analysis be made explicit in reports.

DOCUMENTATION: RETRIEVAL

## An Intelligent Tutor: On-line Documentation and Help for a Military Message Service

**Jeff Rothenberg**
*Information Sciences Institute, University of Southern California, Marina Del Rey*

*Report ISI/RR-74-26, May 1975. NTIS: AD 1010 186/5GA*
*PC $3.75/MF $2.25*

The Tutor accesses a documentation (or Help) data base which contains multilevel descriptions for every "semantic entity" used in the interface between the service and the user. These descriptions are expandable with respect to the amount and type of information presented, as well as with respect to the user's level of proficiency and experience, as indicated by a User Profile. The Tutor also provides a facility for on-line computer-aided instruction. It can be invoked explicitly by the user's request for help, or by the Command Language Processor and User Monitor in response to unrecognized commands, inefficient operation, or error conditions.

## Computer-aided Morphological Synthesis: Pair Elimination Technique.

A. T. Stanley, and E. J. Young
*Army Mobility Equipment Research and Development Center*

*NTIS: AD-786 552/0, June 1974*
*PC $3.25/MF $2.25*

Morphological synthesis is a powerful method for aiding demand ideation. However, it often produces too many ideas. The pair elimination technique is used in conjunction with morphological synthesis. This technique reduces the number of ideas generated, but it does not eliminate practical ideas. A computer is used to rapidly, accurately, and completely perform the many cross-correlations and comparisons of a morphological synthesis with pair elimination.



## Natural Language Based Information Retrieval.

R. P. Gabriel
*University of Illinois*

*NTIS: AD/A-001 131/2, 1974*
*PC $3.25/MF $2.25.*

This paper discusses a natural language data base interrogation system which can allow a nontechnical user to easily obtain information from a large non-uniform data base and which will facilitate extension of a system to new data bases.

## Design of the Underlying Structure for a Data Base Retrieval System

**Stanley R. Petrick**
*IBM Research Center, P.O Box 218, Yorktown Heights, New York 10598*

*Directions in Artificial Intelligence: Natural Language Processing, edited by Ralph Griswold. Report No. NSO-7, Courant Institute of Mathematical Sciences, 1975, pp. 60-84.*

A general transformational component. A semantic interpreter based on a model by Knuth accepts translation equations and associated predicates and functions. Present material describes the Fortune 500; a land-use application is under consideration. Examples of questions and underlying forms. Quantifiers are represented explicity in logical forms. Some predicates (AND) are general; some (TESTFCT) depend on data base structure; others (LOCATED) are specialized, with procedureal definitions. Predicates proliferate; some can be defined in terms of others, and theorem-proving techniques can be used; but semantic representation of complex English sentences is an unsolved problem, and if only a few primitive relations are used the data-base predicates and language predicates do not match.

TRANSLATION

## Chinese-English Machine Translation System

**William S-Y Wang, and Stephen W. Chan**
*University of California, Berkeley*

*Report RADC-TR-75-109, April, 1975; NTIS: AD-A011 715/0GA*
*PC $7.25/MF $2.25*

The system (QUINCE) accepts Chinese input exactly as printed, with no editing of any kind, and produces English output on an experimental basis Coding of Chinese text via Chinese teleprinter System (Model 600D) and subsequent conversion to Standard Telegraphic Code for a direct input to the computer have been successfully completed. Manual keypunching and coding have been completely eliminated.

## An Associative Thesaurus of English: Structural Analysis of a Large Relevance Network

G. R. Kiss
*University of Edinburgh*

*A. Wilkes, eds., Studies in Long Term Memory, New York: John Wiley & Sons, 1975; 103-121: ISBN 0 471 46905 X HC $29.50*

A large word association network (8400 stimulus words, 55,000 nodes) is stored as a directed linear graph with labelled ares. The structure of associations is studied along direct paths (stimulus word to response) and inverse paths (response to stimulus). Both local and global clustering structures are investigated. Work is under way to make the structure into an on-line thesaurus of the Roget type; the use of associative retrieval in human memory is discussed.



## Formal Aspects of Cognitive Processes

Thomas Storer, Editor, and David Winter, Editor

*Lecture Notes in Computer Science, Volume 22, G. Goos and J. Hartmanis, Editors, Springer-Verlag, 1975*
*HC $9.50*

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# Cognition and the Symbolic Processes

Walter B. Weimer, Editor, and David S. Palermo, Editor
*Pennsylvania State University, University Park*

*Lawrence Erlbaum Associates, Inc., Hillsdale New Jersy, 1974 Distributed by the Halsted Press Division John Wiley & Sons, Inc., New York ISBN 0-470-92550-7*
*January 31, 1976 3:46 PM*

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This article is abstracted elsewhere on the fiche.

# Knowledge and Cognition

**Lee W. Gregg, Editor**
*Carnegie-Mellon University*

*Lawrence Erlbaum Associates, Publishers, Potomac, Maryland, 1974 Distributed by the Halsted Press Division of John Wiley & Sons., New York ISBN 0-470-32657-3*

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# Toward a Third Metaphor for Psycholinguistics

**George A Miller**
*Rockefeller University and The Institute for Advanced Study*

*In Weimer and Palmer, Eds., Cognition and the Symbolic Processes, Lawrence Erlbaum Associates, Inc., 397-413, 1974*

When organized about the metaphor of "association", psycholinguistics looked for the connections between words and things. The second metaphor, "communication", directed attention to rules characterizing acceptable signals. "Computation" the third metaphor, directs psycholinguists to look for procedures involved in using language. In this metaphor, knowing a word is defined as being able to compile well-formed programs when that word is part of the input signal. This metaphor doesn't limit research to the word or the sentence level and it does imply that allowance must be made for the use of considerable nonlinguistic information.

## ALLC Bulletin

Joan M. Smith, editor
*6 Sevenoaks Avenue, Heaton Moor, Stockport, Cheshire SK 4 4AW, England*

*Bulletin of the Association for Literary and Linguistic Computing, 3:187, 1975*

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## A Prose Concordance: Rabelais

**J. E. G. Dixon**
*Univeristy of Winnepeg, Manitoba, Canada*

*Bulletin of the Association for Literary and Linguistic Computing 2, No. 3 47-54, 1975*

A citation in a concordance must be long enough to show the contextual matter of the key word, but brief enough to be taken in at a glance. Deficiencies of mechanical methods of selecting citations production of a concordance are discussed. Citation length must be variable and this can be achieved only by pre-editing the text to inset programming 'tags' which indicate the delimitation of a citation. Methods used for Rabelais are described.



## A Vergil Concordance

**Henrietta Holm Warwick**

*University of Minnesota Press, Minneapolis, 1975 ISBN 0-8166-0737-0.*
*PC $45.00*

Computer-produced, keyword-in-context concordance based on the Oxford Classical Text Vergil edited by Sir Roger Mynors. The 83,520 words of the *Eclogues*, *Georgics*, and *Aeneid* are concorded together: 972 pages.

## Computing a Context: Style, Structure, and the Self-Image of Satan in *Paradise Lost*

**Linda-Douglas Misek**
*Department of English, Case Western Reserve University, Cleveland, Ohio*

*Dissertation 1972, University Microfilms No. 72-18716, 2 vols.*
*PC $11.00, MF $5.00*

The events in *Paradise Lost*, including Satan's speeches, occur in the order XYZ, but they are told, in accordance with conventions of epic narration, in the order YZX. This reordering obscures Satan's development as a character. By using automated analysis of Satan's discourse (thematic clusters, syntactic features, audience addressed, and other features) it is possible to reconstruct his *discourse history* in the order XYZ and to thus reveal the coherence of his development. By close examination of the data it is possible to discern how various critics of PL have "edited" the information in the text in order to yield their interpretations of the text. Methods of discourse modeling are discussed as are the techniques used in this analysis and suggestions for future work. A complete Context Concordance to Satan's speeches is included.



## Quantitative Study of *Candide*
*Candide de Voltaire: Etude Quantitative*

**Pierre R. Ducretet, and Marie-Paule Ducretet**
*University of Toronto*

*University of Toronto Press, Downsview, Ontario*
*ISBN 0-8020-2096-8 $50.00 (600 pp., 20 microfiches)*

The volume includes: a word frequency dictionary in descending order, an index verborum, alphabetically sorted by nouns, verbs, etc and their forms, and a line concordance (on microfiches) keyed to a text of *Candide* which is reproduced in the volume. It also provides an introduction describing and interpreting the quantitative data by means of which numerical tables and charts were established. Also included is a good size bibliography on quantitative studies.

## Computer Aided Instruction. Vol. 1 1970-1974 (A Bibliography with Abstracts)

**Mary E. Young**
*National Technical Information Service, Springfield, Virginia.*

*NTIS/PS-75/557/9GA, July 1975*
*PC $25.00/MF $25.00*

Studies on motivation, technical training, learning factors, human factors engineering. 217 abstracts.



## Computer Aided Instruction. Volume 2. 1974-May 75 (A Bibliography with Abstracts)

**Mary E. Young**
*National Technical Information Service, Springfield, Virginia*

*NTIS/PS-75/556/1GA, July 1975*
*PC $25.00/MF $25.00*

Same as Volume 1. 75 abstracts.

## A Question-Answering System for Elementary Mathemetics

N. W. Smith
*California Institute for Mathematical Studies in Social Science, Stanford University, Stanford, California 94305*

*19 April 1974, EDRS No. ED093703*
*MF $0.75; HC $7.50*

The project involves the development of both a theoretical model of natural language processing by computer and an actual implementation of the theory as a question-answering system for elementary mathematics which uses unrestricted natural language input. Details of the question-answering system are given and basic features in the perspective of the theoretical model are discussed.



## SOPHIE: A Step Toward Creating a Reactive Learning Environment

John Seely Brown, Richard R. Burton, and Alan G. Bell
*Computer Science Division, Bolt Beranek and Newman Inc., 50 Moulton Street, Cambridge, Massachusetts 02138*

*International Journal of Man-Machine Studies 7:675-696, 1975*

SOPHIE consists of: 1) A simulator program modeling a "piece of knowledge"--in this case an electronic instrument to be used in teaching electronic trouble-shooting. 2) A set of hypothesis evaluation procedures allowing the computer to check the consistency of a hypothesis suggested by the student against the measurements the student has taken. 3) A set of hypothesis generation procedures allowing SOPHIE, in response to a request for help, to suggest hypotheses which would explain the measurements the student has taken so far. 2) and 3) make extensive use of the simulator plus numerous procedural specialists. A top-down (goal oriented), context-free, fuzzy parser which makes predictions on the basis of semantic categories allows communication with SOPHIE in natural language. Anaphoric reference and ellipsis can be handled.

## SOPHIE: A Sophisticated Instructional Environment

**John Seely Brown, Richard R. Burton, Alan G. Bell, and Robert J. Bobrow**
*Bolt Beranek and Newman Inc. Cambridge, Massachusetts*

*Final Report, January-June 1974. NTIS: AD-A010 109/7GA*
*PC $4.25/MF $2.25*

SOPHIE implements mixed initiative CAI within a simulated electronics troubleshooting training laboratory interaction. The language processor accepts ellipses and other nonspecific requests and resolves these from dialogue context. A help requesting facility has been provided which will suggest possible faults (based on the student's knowledge about the circuit at the time of request) which could explain the symptoms he has observed. The net effect of modifications is that a dialogue is much more like a conversation with a very skilled tutor who can infer what a student means, based on a complete interaction session, and respond appropriately. The resulting program can be processed through the ARPA network.



## Reasoning from Incomplete Knowledge; Semi-annual Report, 1 Aug 74 - 31 Jan 75

**Allan Collins, Eleanor H. Warnock, Nelleke Aiello, and Mark L. Miller**
*Bolt Beranek and Newman Inc., 50 Moulton Street, Cambridge, Massachusetts 02138*

*Report No. 3019, TR-4/1975;AD-A007 560/6GA*
*(PC$4.25, MF $2.25)*

How people use a variety of plausible, but uncertain, inferences to answer questions about which their knowledge is incomplete. This kind of reasoning is described in terms of how it is being implemented in the SCHOLAR/CAI SYSTEM. How people can be taught to reason in this way, using a Socratic tutorial method implemented in a system like SCHOLAR.

## An 'Intelligent' On-line Assistant and Tutor: NLS-SCHOLAR; Semi-annual Report 1 Aug 74-31 Jan 75

**Mario C. Grignetti, Catherine Hausmann, and Laura Gould**
*Bolt Beranek and Newman Inc., 50 Moulton Street, Cambridge, Massachusetts 02138*

*Report No. 2974, 1974; AD-A007 558/0GA*
*PC $3.75; MF $2.25*

NLS-SCHOLAR is a prototype system that uses AI techniques to teach computer-naive people how to use a powerful and complex editor. It represents a new kind of CAI system that integrates systematic teaching with actual practice, i.e. one that can keep the user under tutorial supervision while allowing him to try out what he learns on the system he is learning about. NLS-SCHOLAR can also be used as an on-line help system outside the tutorial environment, in the course of a user's actual work. This capability of combining on-line assistance with training is an extension of the traditional notion of CAI. The techniques of NLS-SCHOLAR are general and can be applied to a wide variety of computer-related activities.



## Natural Language Acquisition by a Robot

**H. D. Block**
*Department of Theoretical and Applied Mechanics*

**Janice Moulton, and G. M. Robinson**
*Department of Psychology, Cornell University, Ithaca, New York*

*International Journal of Man-Machine Studies 7:571-608, 1975*

A robot with a perceptual and motor system but with no pre-programmed linguistic information can acquire language competence by interacting with a linguistically competent teacher. The cognitive system consists of a World Map (for a restricted world), an Associator, which mediates information flow among other components of the system, a Dictionary, and a Syntax Crystal, a new syntactic model which utilizes dependency relations and production rules. The complete system has not yet been computer simulated. Two hand simulation games are described: one models the syntax crystal and the other shows how the robot develops semantic and syntactic systems through experience in its world.

## Robots (a bibliography with abstracts)

**D. W. Grooms**
*National Technical Information Service*

*NTIS: NTIS/PS-75/064/6, January 1975.*
*PC $25.00/MF $25.00*

89 selected abstracts citing reasearch on the design and application of robots. Included are studies on software development, memory models, manipulation control algorithms, problem solving features of robots and space exploration applications.

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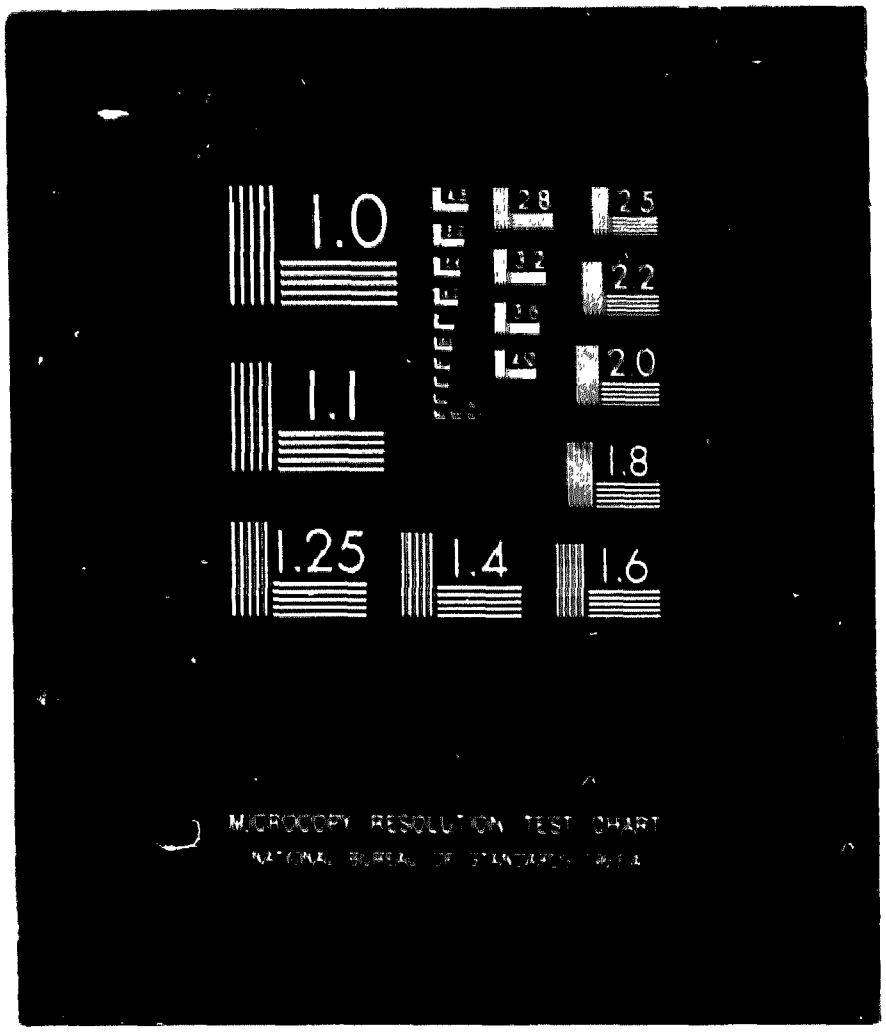
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