

**32nd  
Annual Meeting  
of the  
Association for  
Computational Linguistics**

**Proceedings of the Conference**

**27-30 June 1994  
New Mexico State University  
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## PREFACE

This volume contains the papers presented at the 32nd Annual Meeting of the Association for Computational Linguistics, held June 27-30, 1994, at New Mexico State University in Las Cruces, New Mexico. In addition to the papers from the main session, these proceedings include the papers from the student sessions as well.

This year marked the first time ACL accepted papers by electronic submission. Surprisingly, over half of the authors decided to submit electronically, but because of the newness of the medium for the conference, most authors also submitted paper copies as well. Except for some minor problems with formatting and mailer difficulties, the process went remarkably well. I believe in a few years, we will be ready to convert entirely to electronic submission and reviewing.

I would especially like to thank our invited speakers, Aravind Joshi and Paul Smolensky, for giving of their time and ideas at the conference. I would also like to thank the tutorial chair, Lynette Hirschman, and her tutorial instructors, Steven Bird, Stephenie Seneff, Richard Sproat, Michael Riley, and David Searls. And for organizing the student sessions of the conference, I would like to thank Beryl Hoffman and Rebecca Passonneau. Special thanks go to the local arrangements director, Janyce M. Wiebe, and to Ted Dunning for arranging and coordinating exhibits and demos.

Because of the number and quality of the submissions this year, the committee was burdened with a formidable reviewing task. But the committee performed beautifully and the meeting went very smoothly. I would like to once again acknowledge their service here:

Hiyan Alshawi (AT&T), Bran Boguraev (Apple Inc.), Ted Briscoe (Cambridge U. and Xerox Grenoble), Garrison Cottrell (UC-San Diego), Laurence Danlos (Université Paris 7), Marc Gawron (SRI), Pierre Isabelle (CITI), Mark Johnson (Brown University), Alex Lascarides (Stanford University), Lori Levin (CMU), David Lewis (AT&T), Marie Meteer (BBN), Livia Polanyi (Rice University and CSLI), Mats Rooth (University of Tübingen), Yoshinori Sagisaka (ATR), Keh-Yih Su (National Tsing Hua University), Evelyne Tzoukermann (AT&T), Hans Uszkoreit (Universität des Saarlandes) and K. Vijay-Shanker (University of Delaware and DFKI)

Local help with preparing the papers for the committee and mailing came from Federica Busa, Robert Ingria, and Scott Waterman. My gratitude to their invaluable assistance, as things would not have run so smoothly without them.

I would also like to mention the help we received from the external reviewers, Robert Ingria and David McDonald, who lent their expertise where needed.

Finally, I would like to thank Fernando Pereira, for his time and effort in preparing the program announcement and proceedings, yet another task on top of his other ACL responsibilities, and Betty Walker, whose constant and continuing support has made the transition possible each year from meeting to meeting. Betty and Don's commitment to and faith in the field have been an inspiration to us all, and a mainstay of the community.

I would like to dedicate these proceedings to the memory of Don Walker.

James Pustejovsky, Brandeis University  
Chair, Program Committee



# CONFERENCE PROGRAM

## MONDAY, 27 JUNE: Tutorials

- 9:00-12:30 *Computational Phonology*  
Steven Bird
- Spoken Language Understanding Systems*  
Stephanie Seneff
- 2:00-5:30 *Text Analysis Tools in Spoken-Language Processing*  
Richard Sproat & Michael Riley
- Linguistics & Biology*  
David Searls

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David R. Traum & James F. Allen
- 9:25-9:50 *Multi-Paragraph Segmentation of Expository Text*  
Marti A. Hearst
- 9:50-10:15 *Priority Union and Generalization in Discourse Grammars*  
Claire Grover, Chris Brew, Suresh Manandhar & Marc Moens
- 10:15-10:40 *Hidden Understanding Models of Natural Language*  
Scott Miller, Robert Bobrow, Robert Ingria & Richard Schwartz
- 11:10-12:15 INVITED TALK: *From Strings to Trees to Strings to Trees ...*  
Aravind K. Joshi
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- 1:45-2:10 *Intentions and Information in Discourse*  
Nicholas Asher & Alex Lascarides
- 2:10-2:35 *Generating Precondition Expressions in Instructional Text*  
Keith Vander Linden
- 2:35-3:00 *Common Topics and Coherent Situations: Interpreting Ellipsis in the Context of Discourse Inference*  
Andrew Kehler
- 3:00-3:25 *A Hybrid Reasoning Model for Indirect Answers*  
Nancy Green & Sandra Carberry
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- 1:45-2:10 *A Stochastic Finite-State Word-Segmentation Algorithm for Chinese*  
Richard Sproat, Chilin Shih, William Gale & Nancy Chang
- 2:10-2:35 *Precise N-Gram Probabilities from Stochastic Context-free Grammars*  
Andreas Stolcke & Jonathan Segal
- 2:35-3:00 *Aligning a Parallel English-Chinese Corpus Statistically with Lexical Criteria*  
Dekai Wu
- 3:00-3:25 *Decision Lists for Lexical Ambiguity Resolution: Application to Accent Restoration in Spanish and French*  
David Yarowsky
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- 3:55-4:20 *An Empirical Model of Acknowledgment for Spoken-language Systems*  
David G. Novick & Stephen Sutton
- 4:20-4:45 *Speech Dialogue with Facial Displays: Multimodal Human-computer Conversation*  
Katashi Nagao & Akikazu Takeuchi
- 5:15-5:40 *Interleaving Syntax and Semantics in an Efficient Bottom-up Parser*  
John Dowding, Robert Moore, François Andry & Douglas Moran
- 5:40-6:05 *An Optimal Tabular Parsing Algorithm*  
Mark-Jan Nederhof
- 6:05-6:30 *A Psycholinguistically Motivated Parser for CCG*  
Michael Niv

WEDNESDAY, 29 JUNE

- 9:00-9:25 *Verbs Semantics and Lexical Selection*  
Zhibiao Wu & Martha Palmer
- 9:25-9:50 *Word-Sense Disambiguation Using Decomposable Models*  
Rebecca Bruce & Janyce Wiebe
- 10:45-11:10 *Constraint-based Categorical Grammar*  
Gosse Bouma & Gertjan van Noord
- 11:10-11:35 *Capturing CFLs with Tree Adjoining Grammars*  
James Rogers
- 11:35-12:00 *On Determining the Consistency of Partial Descriptions of Trees*  
Thomas L. Cornell
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- 1:30-1:55 *A Markov Language Learning Model for Finite Parameter Spaces*  
Partha Niyogi & Robert C. Berwick
- 1:55-2:20 *Part-of-speech Tagging Using a Variable Memory Markov Model*  
Hinrich Schütze & Yoram Singer
- 2:20-2:45 *Grammar Specialization Through Entropy Thresholds*  
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- 5:50-6:15 *Multiset-valued Linear Index Grammars: Imposing Dominance Constraints on Derivations*  
Owen Rambow

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| 9:00-9:20   | <i>Reaping the Benefits of Interactive Syntax and Semantics</i><br>Kavi Mahesh                     |
| 9:20-9:40   | <i>Graded Unification: a Framework for Interactive Processing</i><br>Albert Kim                    |
| 9:40-10:00  | <i>An Integrated Heuristic Scheme for Partial Parse Evaluation</i><br>Alon Lavie                   |
| 10:10-10:30 | <i>Temporal Relations: Reference or Discourse Coherence?</i><br>Andrew Kehler                      |
| 10:30-10:50 | <i>Simulating Children's Null Subjects: An Early Language Generation Model</i><br>Carole T. Boster |
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| 9:00-9:20   | <i>Dual-Coding Theory and Connectionist Lexical Selection</i><br>Ye-Yi Wang   |
| 9:20-9:40   | <i>Integration Of Visual Inter-word Constraints and Linguistic Knowledge in Degraded Text Recognition</i><br>Tao Hong |
| 9:40-10:00  | <i>An Automatic Method of Finding Topic Boundaries</i><br>Jeff C. Reynar  |
| 10:10-10:30 | <i>Automatic Alignment in Parallel Corpora</i><br>Harris Papageorgiou, Lambros Cranias & Stelios Piperidis            |
| 10:30-10:50 | <i>Conceptual Association for Compound Noun Analysis</i><br>Mark Lauer  |
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|-----------|---|
| 1:30-2:35 | INVITED TALK: <i>Optimality Theory: Universal Grammar, Learning and Parsing Algorithms, and Connectionist Foundations</i><br>Paul Smolensky & Bruce Tesar |
| 2:35-3:00 | <i>Similarity-based Estimation of Word Cooccurrence Probabilities</i><br>Ido Dagan, Fernando Pereira & Lillian Lee  |
| 3:00-3:25 | <i>Acquiring Receptive Morphology: A Connectionist Model</i><br>Michael Gasser  |
| 3:50-4:15 | <i>Relating Complexity to Practical Performance in Parsing with Wide-coverage Unification Grammars</i><br>John Carroll                                    |
| 4:15-4:40 | <i>Detecting and Correcting Speech Repairs</i><br>Peter Heeman & James F. Allen   |
| 4:40-5:05 | <i>A Computational View of the Cognitive Semantics of Spatial Prepositions</i><br>Patrick Olivier & Jun-ichi Tsujii                                       |

## TUTORIALS

### **Computational Phonology**

*Steven Bird, University of Edinburgh*

In their search for linguistic application domains, computational linguists have for too long ignored phonology. This field—the oldest discipline in linguistics—has a richness and complexity largely unexplored from a computational standpoint. Recently, however, computational phonology has been rapidly gaining recognition as an independent area of inquiry within computational linguistics. The aim of the tutorial is to introduce phonology and computational phonology to computational linguists and to review some of the recent developments in the latter field. It will begin with an introduction to the principles of phonology, including distinctive feature theory, underspecification and markedness, subsegmentals and suprasegmentals, and non-linear phonological representation. Next, an introduction to computational phonology will be presented: its origins, its principal theoretical and computational devices and its relationship to other fields. This will lead into a survey of various computational approaches to phonology, including a selection of recent work using computational models such as deductive inference, neural networks and finite-state devices. The final part of the tutorial will be a presentation of a particular family of approaches to computational phonology, called ‘declarative phonology’, which admits a variety of formal and computational methods from logic, abstract specification, automata theory and artificial intelligence.

### **Spoken Language Understanding Systems**

*Stephanie Seneff, MIT LCS*

Over the past five years, a new discipline in human language technology has emerged, namely, spoken language systems, combining speech and natural language technologies in order to achieve speech understanding. Spoken language systems will play an important role in providing access to the future information highway, being the most natural means for obtaining information from large databases, such as online Yellow Pages. The tutorial will cover four major topics. First, I will discuss why natural language systems must have the capability of responding even when the input is malformed, and describe how we have achieved this goal through “robust parsing”. My second topic will address ways in which the natural language component can interact with the recognizer to improve its performance. The third topic deals with the importance of discourse and dialogue modelling, and discusses techniques we have developed for building effective mixed initiative systems. A fourth issue that will need to be addressed for real systems is the out-of-vocabulary problem — it will become increasingly important for the system to be able to recognize what it doesn't know, and dynamically update its vocabulary through interaction with the user. A video tape illustrating the MIT systems will be shown.

### **Text Analysis Tools in Spoken-Language Processing**

*Richard Sproat and Michael Riley, AT&T Bell Laboratories*

The basic problem to be solved by text-to-speech (TTS) systems can be simply stated: the task is to convert text, in some language, into sounds that resemble a native speaker of that language reading the text. The problem breaks down naturally into a number of steps, requiring various kinds of linguistic analysis, including text-normalization, grapheme-to-phoneme conversion, intonational phrase-boundary prediction and intonational prominence prediction. In many TTS systems, problems such as those above are handled by essentially rule-based methods specifically designed for TTS. This tutorial will present a different take on the latter two points. First, although we would stress that traditional rule-based methods still play an important role in TTS (as in other areas of natural language and speech analysis), our primary focus in this tutorial will be on the application of probabilistic — or ‘corpus-based’ — methods. Second, TTS modules should not be designed with the sole application of TTS in mind; rather they should be viewed as natural language analysis modules whose applications include other domains, such as automatic speech recognition (ASR) and spoken language identification (SLI); as we shall show, this view has important implications for the design of such modules.

### **Linguistics and Biology**

*David Searls, University of Pennsylvania*

The realms of formal language theory and computational linguistics have heretofore extended primarily to natural languages, artificial computer languages, and little else in the way of serious applications. However, because of rapid advances in the field of molecular biology it now appears that biological sequences such as DNA and protein, which are after all composed quite literally of sets of strings over well-defined chemical alphabets, may well become the third major domain of the tools and techniques of mathematical and computational linguistics. The work of the speaker and a number of others has served to establish the “linguistic” character of biological sequences from both formal and practical perspectives, while at the same time the international effort to map and sequence the human genome is producing data at a prodigious rate. Not only does this data promise to provide a substantial substrate for further development of the linguistic theory of DNA, but its enormous quantity and variety may demand just such an analytic approach, with computational assistance, for its full understanding.

The tutorial will be divided into three sections of roughly one hour each. In the first section, an overview of the essential facts of molecular biology will be presented, concentrating on basic genetics, the biochemistry of biological sequences, genome organization, and mechanisms of gene expression. The second section will cover formal language-theoretic aspects of DNA. These include proofs of the positions of biologically-relevant languages in the Chomsky hierarchy, closure properties of languages under biological string operations, linguistic aspects of evolution, and especially the important role played by syntactic ambiguity in the structure and function of genetic material. Building upon these formal foundations, the third section will examine applications of grammar-based approaches to biological sequences, in particular in the area of syntactic pattern recognition.



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## PREFACE TO THE STUDENT SESSION PAPERS

These proceedings include the papers presented at the Student Sessions of the 32nd Annual Meeting of the Association for Computational Linguistics. The ACL student sessions provide an opportunity for student ACL members to present work-in-progress and receive valuable feedback on their research from other members of the computational linguistics community. The sessions are in a workshop-style, consisting of short paper presentations by student authors; students and senior researchers who are not presenting are invited to participate in the discussion.

This year, there were forty-one submissions to the ACL Student Sessions. Ten were accepted for presentation at the conference. We thank all the students authors for submitting their papers, and hope that the reviews encourage them in their research, provide constructive criticism, and introduce them to the process of disseminating their work more broadly.

We are grateful to the reviewers for providing helpful, detailed reviews of the submissions. We thank the members of the ACL 1994 Student Sessions Committee who helped plan the Student Sessions and served as reviewers: Jennifer Chu (Delaware), Jason Frank (Ohio State), Steve Green (Toronto), Vasileios Hatzivassiloglou (Columbia), Peter Heeman (Rochester), Chris Manning (Stanford), Gaelle Recource (Paris 7), Sheila Rock (Edinburgh), and Suzanne Stevenson (Toronto and Maryland). Sheila Rock helped us organize the committee, and Eric Iverson (NMSU) organized the student local arrangements. We also thank the nonstudent reviewers on the committee whose experience as senior researchers was invaluable: Chinatsu Aone (SRA), Alan Black (ATR Japan), Ken Church (AT&T), Robert Frank (Delaware), Megumi Kameyama (SRI), Robert Kasper (Ohio-State), Chris Mellish (Edinburgh), Gord McCalla (Saskatchewan), John Nerbonne (Groningen), and Ingrid Zukerman (Monash). We are also grateful to Linda Z. Suri and Sandra Carberry, last year's student sessions co-chairs, for their advice and guidance.

Beryl Hoffman and Rebecca Passonneau  
Student Sessions Co-Chairs

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