Carnegie Mellon University
SPRING 1996

Department: Philosophy
Course: 80-682/882
Units: 12
Room: PH A21A
Time: WF 9:30 – 11:20

Natural Language Processing II

Pragmatics and Discourse Processing

Instructor: Barbara Di Eugenio
Office: 152 Baker Hall
Phone: x8149
E-mail: dieugeni@andrew.cmu.edu
Office Hours: to be established.

Teaching Assistant: Octav Popescu
Office: BH 360
Phone: x8062
E-mail: octav+@andrew.cmu.edu

Course Objectives

This course has two main objectives: first, provide students with a sound basis in Pragmatics and Discourse Processing; second, examine how certain types of semantic and pragmatic information are represented and manipulated in natural language processing systems. We will draw material from the linguistics, artificial intelligence and computational linguistics literatures.

After completing the course, students should be able to read articles on computational approaches to semantics and pragmatics and critically analyze their theoretical and practical merits. A second goal is for students to be able to apply the theories and techniques encountered in the course to the analysis of naturally occurring texts.

Course Organization

In the first part of the term, I will present and discuss notions from the pragmatics and discourse processing literatures; in the second part of the term, we will discuss computational approaches to representing and manipulating (some) semantic and pragmatic information. In the last third of the semester, students are required to choose one paper, and present it in class. The final two classes will be devoted to conference style presentations of the results of the students' projects.

Textbooks

While there's no textbook that covers the material to be covered in class, I will draw some material from [Levinson, 1983] (pragmatics) and (little) from [Allen, 1995] (CL). Both [Levinson, 1983] and [Allen, 1995] are good reference books, that I'd recommend you buy sooner or later.

The rest of the readings will be journal and conference papers; they will be available from the philosophy office.

Assignments

- **Reading and Classroom Participation** (about 10%)

  While the first part of the course will be lecture oriented, there should still be space for discussion; the second part of the course will be discussion oriented in its entirety. For this to work, you *must* read the assigned papers *before* the class in which they are discussed. Part of the grade for this class will be based on classroom participation. I recommend that you prepare a list of issues and questions on each required paper before the meeting in which we discuss the papers. If I realize that students don't read the papers, I will start handing out surprise quizzes.

- **Class Presentations (Critical Essays)** (about 10%)

  Students will be required to present one or two papers (the number of presentations will depend on class size). For each paper a student presents, s/he will have to write a short critique (about 2-3 pages), to be turned in the class before the one we discuss the paper.

- **Midterm Assignment (40%).** Two parts:

  - **Analysis of Naturally Occurring Text** (about 20%)
    Due two weeks after the end of the first part of the course — probably around 3/10.
    I will provide a page each of two naturally occurring texts of different genre, eg a newspaper article, a short story, a technical article, instructional text, interviews etc. Analyze each of them from the following two points of view:

    1. Build the discourse structure according to [Grosz and Sidner, 1986] and to [Mann and Thompson, 1988]. Compare and critique the two analyses: are the theories spelled out enough that they are really usable? what are the assumptions you as discourse analyst have to make? what are the advantages and disadvantages of each approach?
    2. Identify examples of the notions we discuss in the first part of the class — conversational implicatures, presuppositions, speech acts.

    Hand in: the two discourse structure analyses of the two texts; 2-3 pages of comparison and critique of the two approaches; 1 page with examples of conversational implicature etc. NB: if you don't find many such examples, try to provide an explanation: e.g. is it because of the particular kind of text?

  - A **short programming assignment**, still to be determined. Most likely, the implementation of a simple algorithm for pronoun interpretation (20%).

- **Class Project** (about 40%)
  Due dates:

  - 4/3: 1 page Project Proposal;
  - 5/3: Project Presentations;
  - 5/8: Project Report

  To be presented in a conference-like format during the last two classes of the term (and / or in a separate meeting if necessary). A short project proposal to me by beginning of March (clearly this may require that you start looking ahead to the topics we will discuss in the second part of the class). While I don't expect a research paper, I do expect something more than a pure summary of two or three papers on a certain topic.

  The following is a *tentative, by no means exhaustive* list of possible projects:

  1. Study how one of the approaches we have studied could be extended to other kinds of phenomena / data. Examples could be:
     - Discourse segmentation and intonation.
     - Syntactic cues for discourse segmentation.
     - Pronominal systems in languages different from English and pronominal resolution (or centering).
     - Metonymy and Metaphor.
  2. Implement (part of) one of the approaches we discuss (e.g. generation of logical form, reference resolution algorithms, speech act recognition), and test the algorithm on a small corpus of your choice.
  3. (dispreferred: if you do it, the **critique** part must be **really substantial**.) Choose a topic and write a critique of two-three papers relating to that topic. Possible topics are:
     - Theory and Computation of Metaphor and Metonymy
     - Attachment Ambiguity and the Syntax/Semantics/Pragmatics Interface
     - Default Reasoning and Discourse

- Naive Semantics and NLP
- Lexical Semantics and its Relation to Discourse
- Processing Ellipsis
- Knowledge Representation Formalisms and NLP
- Representation of Plurals and Mass Terms
- Topic, Focus and Discourse Structure
- Systemic Choice Systems and Functional Approaches to Computational Semantics and Pragmatics
- Representing Intensional Reasoning

Whatever project you choose, it is strongly advised that you test your ideas with really occurring data. Feel free to work on languages other than English.

Written report: at least 5 pages if project includes implementation, at least 10 if not.

Course Outline and Readings

Foundations of pragmatics and discourse processing

Overview: 1/17

Introduction to Pragmatics (8 classes).

1. About Pragmatics (1/17): [Levinson, 1983], Ch. 1.
2. Conversational Implicature (1/19-24): [Levinson, 1983], Ch. 3 (except 3.2.5 — 3.2.6).
    - [Grice, 1991], excerpts from Chapter 6 in [Horn, 1989].
      Other readings: [Horn, 1984].
3. Presupposition (1/26-31): [Levinson, 1983], Ch. 4.
    - [Soames, 1982].
      Further readings: [Karttunen, 1973], [Gazdar, 1979], [Heim, 1983].
4. Speech Acts (2/2-7): [Levinson, 1983], Ch. 5.
    - [Searle, 1965; Searle, 1975].
5. The Given / New contract (2/9): [Clark and Haviland, 1977], [Prince, 1981].

Discourse Processing: Theories of Discourse Structure (4 classes).

1. Attention and intention: [Grosz and Sidner, 1986], [Walker, 1996] (2/14).
2. Rhetorical Structure Theory:
    - (2/16) The theory: [Mann and Thompson, 1988].
      Other readings: [Mann and Thompson, 1986; Mann and Thompson, 1988].
    - (2/21) Problems with RST: [Moore and Pollack, 1993]. An application of RST to NL generation: [Moore and Paris, 1993].
3. [Polanyi, 1988], [Hobbs, 1985] (2/23).

Further readings: [Rambow, 1993].

Computational Issues in Semantics / Pragmatics

Interpretation and Logical Form (2 classes)

1. [Hobbs *et al.*, 1993] (2/28).
2. [Pereira and Pollack, 1991] (3/1).

Further readings: [Moore, 1981], [Schubert and Pelletier, 1982], [Hobbs and Shieber, 1987].Introduction (from [Allen, 1995], Ch. 7—10)

NL generation (2 guest lectures: Nancy Green, CS, CMU)

1. Content generation (3/6): [McKeown, 1985; Hovy, 1993]
2. Generation of referring expressions (3/8): [Appelt, 1985; Dale and Reiter, 1995].

Other readings: [Dale, 1989].

Knowledge representation for NLP (5 classes)

1. Introduction, Semantic Networks [Lehmann, 1992], KL-ONE and derivatives [Brachman and Schmolze, 1985] (3/13).
2. SNePS [Shapiro and Rapaport, 1992], Conceptual dependency [Lytinen, 1992] (3/15).
3. Lexical semantics
   (a) excerpts from [Shapiro, 1992], [Pustejovsky and Boguraev, 1993] (3/20).
   (b) WORDNET [Miller *et al.*, 1990], and a computational application [Resnik, 1993]. (3/22)

   *** 3/27, 3/29: spring break ***

   (c) Jackendoff's Conceptual Structures (CS) (4/3): ch. 1 and 2 from [Jackendoff, 1990]; a criticism of CS [Wilks, 1992] and Jackendoff's reply [Jackendoff, 1992]; an application [Di Eugenio, 1994].
   Other readings: [Jackendoff, 1983],[Dorr, 1993],[Di Eugenio and Webber, 1996].

Further readings: [Sowa, 1992; Sowa, 1993; Wilks and Fass, 1992; CMW, 1992a; CMW, 1992b].

Selected Topics

Anaphora and focusing (4 classes).

1. Representation (4/5): [Webber, 1983].
   Further readings: [Kamp, 1981], [Heim, 1982].
2. Focusing (4/10): [Sidner, 1983].
3. Anaphora resolution:
   - Centering (4/12): [Grosz *et al.*, 1995], [Brennan *et al.*, 1987].
     Further readings: [Kameyama, 1985; Walker *et al.*, 1994; Shima, 1995], [Gordon *et al.*, 1993], [Di Eugenio, 1990; Di Eugenio, 1996], [Suri and McCoy, 1994], [Turan, 1995].
   - Other approaches, evaluation (4/17): [Walker, 1989], [Lappin and Leass, 1994].

Further reading: Discourse deixis: [Webber, 1991].

Tense, Aspect and Discourse (1 class).

1. [Moens and Steedman, 1988], [Passonneau, 1988] (4/19).

Further readings: other papers in [CL, 1988], in particular [Webber, 1988].

Intentions, Planning and Plan Inference (4 classes).

1. Planning approach to speech acts (4/22): [Perrault and Allen, 1980], [Litman and Allen, 1990].
   Other readings: [Cohen and Perrault, 1979], [Pollack, 1990].
2. (4/24) [Lambert and Carberry, 1991], [Lambert and Carberry, 1992], [Penstein Rosé *et al.*, 1995].
   Other readings: [Carberry, 1988].
3. Building on [Grosz and Sidner, 1986] 4/26: [Lochbaum *et al.*, 1990; Grosz and Kraus, 1993; Lochbaum, 1995].
   Other readings:[Lochbaum, 1991], [Lochbaum, 1993], [Lochbaum, 1994].
4. Planning text and graphics (5/1): [Wahlster *et al.*, 1993].

Further readings: other papers from [Cohen *et al.*, 1990].

5/3: **PROJECT PRESENTATIONS**

References

[Allen, 1995] James Allen. *Natural Language Understanding — 2nd Edition.* The Benjamin/Cummings Publishing Company, 1995.

[Appelt, 1985] Douglas Appelt. Planning English referring expressions. *Artificial Intelligence*, 26(1):1–33, 1985. Also in *Readings in Natural Language Processing*, Grosz, Sparck Jones and Webber eds., Morgan-Kaufmann, 1986.

[Brachman and Schmolze, 1985] Ronald Brachman and James Schmolze. An Overview of the KL-ONE Knowledge Representation system. *Cognitive Science*, 9:171–216, 1985.

[Brennan *et al.*, 1987] Susan Brennan, Marilyn Walker Friedman, and Carl Pollard. A centering approach to pronouns. In *Proc. 25th Meeting, Association for Computational Linguistics*, pages 155–162, 1987.

[Carberry, 1988] Sandra Carberry. Modeling the User's Plans and Goals. *Computational Linguistics*, 14(3):23–37, 1988.

[CL, 1988] Computational Linguistics, Special Issue on Tense and Aspect, 14(2), 1988.

[Clark and Haviland, 1977] Herbert H. Clark and Susan E. Haviland. Comprehension and the given-new contract. In Roy O. Freedle, editor, *Discourse Production and Comprehension*, volume 1 of *Discourse Processes: Advances in Research and Theory*, pages 1–40. Ablex Publishing Corporation, 1977.

[CMW, 1992a] Computers and Mathematics with Applications, Special Issue on Semantic Networks in Artificial Intelligence, Part 1. Fritz Lehmann ed., 23(2-5), 1992.

[CMW, 1992b] Computers and Mathematics with Applications, Special Issue on Semantic Networks in Artificial Intelligence, Part 2. Fritz Lehmann ed. 23(6-9), 1992.

[Cohen and Perrault, 1979] Philip Cohen and Raymond Perrault. Elements of a Plan-Based Theory of Speech-Acts. *Cognitive Science*, 3:177–212, 1979.

[Cohen *et al.*, 1990] Philip Cohen, Jerry Morgan, and Martha Pollack, editors. *Intentions in Communication.* MIT Press, 1990.

[Dale and Reiter, 1995] Robert Dale and Ehud Reiter. Computational interpretations of the gricean maxims in the generation of referring expressions. *Cognitive Science*, 18:233–263, 1995.

[Dale, 1989] Robert Dale. Cooking up referring expressions. In *Proceedings of the Twenty-Seventh Annual Meeting of the Association for Computational Linguistics*, pages 68–75, 1989.

[Di Eugenio and Webber, 1996] Barbara Di Eugenio and Bonnie Lynn Webber. Pragmatic Overloading in Natural Language Instructions. *International Journal of Expert Systems, Special Issue on Knowledge Representation and Reasoning for Natural Language Processing*, 9(2), March 1996. To appear.

[Di Eugenio, 1990] Barbara Di Eugenio. Centering Theory and the Italian Pronominal System. In *Proceedings 13th International Conference on Computational Linguistics (COLING 90)*, pages 270–275, 1990.

[Di Eugenio, 1994] Barbara Di Eugenio. Action Representation for interpreting Purpose Clauses in Natural Language Instructions. In J. Doyle, E. Sandewall, and P. Torasso, editors, *Principles of Knowledge Representation and Reasoning: Proceedings of the Fourth International Conference (KR94).* Morgann Kaufmann, San Mateo, CA, 1994.

[Di Eugenio, 1996] Barbara Di Eugenio. Centering in Italian, 1996. *Centering in Discourse*, Ellen Prince, Aravind Joshi, Lyn Walker editors, Oxford University Press. To appear.

[Dorr, 1993] Bonnie J. Dorr. Interlingual machine translation: a parameterized approach. *Artificial Intelligence*, 63(1–2), 1993.

[Gazdar, 1979] Gerald Gazdar. A solution to the projection problem. In C.-K. Oh and D.A. Dinneen, editors, *Syntax and Semantics 11. Presupposition.* Academic Press, 1979.

[Gordon *et al.*, 1993] Peter Gordon, Barbara Grosz, and Laura Gilliom. Pronouns, Names, and the Centering of Attention in Discourse. *Cognitive Science*, 17:311–347, 1993.

[Grice, 1991] H.P. Grice. Logic and Conversation. In Steven Davis, editor, *Pragmatics. A Reader*. Oxford University Press, 1991. Originally published in *Studies in the Way of Words*, by Paul Grice, Harvard University Press, 1968.

[Grosz and Kraus, 1993] Barbara J. Grosz and Sarit Kraus. Collaborative Plans for Group Activities. In *Proceedings of IJCAI 93*, Chambery, France, 1993.

[Grosz and Sidner, 1986] Barbara Grosz and Candace Sidner. Attention, Intentions, and the Structure of Discourse. *Computational Linguistics*, 12:175–204, 1986.

[Grosz *et al.*, 1995] Barbara Grosz, Aravind Joshi, and Scott Weinstein. Centering: A Framework for Modeling the Local Coherence of Discourse. *Computational Linguistics*, 21(2):203–225, 1995.

[Heim, 1982] Irene Heim. *The Semantics of Definite and Indefinite Noun-Phrases.* PhD thesis, University of Massachusetts, 1982.

[Heim, 1983] Irene Heim. On the Projection Problem for Presuppositions. In *Proceedings WCCFL 2*, 1983.

[Hobbs and Shieber, 1987] Jerry Hobbs and Stuart Shieber. An Algorithm for Generating Quantifier Scopings. *Computational Linguistics*, 13, 1987.

[Hobbs *et al.*, 1993] Jerry Hobbs, Mark Stickel, Douglas Appelt, and Paul Martin. Interpretation as Abduction. *Artificial Intelligence, Special Volume on Natural Language processing*, 63(1–2):69–142, 1993.

[Hobbs, 1985] Jerry Hobbs. On the Coherence and Structure of Discourse. Technical Report CSLI-85-37, Center for the Study of Language and Information, Stanford University, 1985.

[Horn, 1984] Laurence Horn. Toward a new taxonomy for pragmatic inference: Q-based and R-based implicature. In *GURT '84. Meaning, form and use in context: linguistic applications.* Georgetown University Press, 1984.

[Horn, 1989] Laurence Horn. *A Natural History of Negation.* The University of Chicago Press, 1989.

[Hovy, 1993] Eduard H. Hovy. Automated discourse generation using discourse structure relations. *Artificial Intelligence*, 63:341–385, 1993.

[Jackendoff, 1983] Ray Jackendoff. *Semantics and Cognition.* Current Studies in Linguistics Series. The MIT Press, 1983.

[Jackendoff, 1990] Ray Jackendoff. *Semantic Structures.* Current Studies in Linguistics Series. The MIT Press, 1990.

[Jackendoff, 1992] Ray Jackendoff. Letters to the Editor, Computational Linguistics, vol. 18(2), 1992.

[Kameyama, 1985] Megumi Kameyama. *Zero anaphora: the case of Japanese.* PhD thesis, Stanford University, 1985.

[Kamp, 1981] Hans Kamp. A Theory of Truth and Semantic Representation. In J. Groenendijk, T. Janssen, and M. Stokhof, editors, *Formal Methods in the Study of Language.* Mathematisch Centrum Tracts, Amsterdam, 1981.

[Karttunen, 1973] Lauri Karttunen. Presuppositions of compound sentences. *Linguistic Inquiry*, 4:169–193, 1973.

[Lambert and Carberry, 1991] Lynn Lambert and Sandra Carberry. A tripartite plan-based model of dialogue. In *Proceedings of the 29th Annual Meeting of the ACL*, pages 47–54, 1991.

[Lambert and Carberry, 1992] Lynn Lambert and Sandra Carberry. Modeling Negotiation Subdialogues. In *ACL92, Proceedings of the 30th Annual Meeting of the Association for Computational Linguistics*, pages 193–200, 1992.

[Lappin and Leass, 1994] Shalom Lappin and Herbert J. Leass. An Algorithm for Pronominal Anaphora Resolution. *Computational Linguistics*, 20(4):535–561, 1994.

[Lehmann, 1992] Fritz Lehmann. Semantic Networks. *Computers and Mathematics with Applications, Special Issue on Semantic Networks in Artificial Intelligence, Part 1*, 23(2–5), 1992.

[Levinson, 1983] Stephen Levinson. *Pragmatics.* Cambridge Textbook in Linguistics. Cambridge University Press, 1983.

[Litman and Allen, 1990] Diane Litman and James Allen. Discourse Processing and Commonsense Plans. In P. Cohen, J. Morgan, and M. Pollack, editors, *Intentions in Communication.* MIT Press, 1990.

[Lochbaum *et al.*, 1990] Karen E. Lochbaum, Barbara J. Grosz, and Candace L. Sidner. Models of plans to support communication. In *AAAI90, Proceedings of the Eighth National Conference on Artificial Intelligence*, Boston, CA, 1990.

[Lochbaum, 1991] Karen Lochbaum. Plan Recognition in Collaborative Discourse. Technical Report TR-14-91, Center for Research in Computing Technology, Harvard University, 1991.

[Lochbaum, 1993] Karen Lochbaum. A Collaborative Planning Approach to Discourse Understanding. Technical Report TR-20-93, Center for Research in Computing Technology, Harvard University, 1993.

[Lochbaum, 1994] Karen E. Lochbaum. *Using Collaborative Plans to Model the Intentional Structure of Discourse.* PhD thesis, Harvard University, 1994. Technical Report TR-25-94.

[Lochbaum, 1995] Karen Lochbaum. The Use of Knowledge Precondition in Language Processing. In *IJCAI95, Proceedings of the 14th International Joint Conference on Artificial Intelligence*, pages 1260–1266, 1995.

[Lytinen, 1992] Steven Lytinen. Conceptual Dependency and its descendants. *Computers and Mathematics with Applications, Special Issue on Semantic Networks in Artificial Intelligence, Part 1*, 23(2–5), 1992.

[Mann and Thompson, 1986] William C. Mann and Sandra Thompson. Rhetorical Structure Theory: Description and Construction of Text Structures. In *Third International Workshop on Text Generation, Nijmegen, The Netherlands*, 1986. Also available as ISI Reprint Series ISI/RS-86-174.

[Mann and Thompson, 1988] William C. Mann and Sandra Thompson. Rhetorical Structure Theory: toward a Functional Theory of Text Organization. *Text*, 8(3):243–281, 1988. A preliminary version appears as ISI Technical Report RS-87-190.

[McKeown, 1985] Kathleen R. McKeown. Discourse strategies for generating natural-language text. *Artificial Intelligence*, 27:1–41, 1985. Also in *Readings in Natural Language Processing*, Grosz, Sparck Jones and Webber eds., Morgan-Kaufmann, 1986.

[Miller *et al.*, 1990] George A. Miller, Richard Beckwith, Christiane Fellbaum, Derek Gross, and Katherine Miller. Five papers on WordNet. Technical Report CSL 43, Cognitive Science Laboratory, Princeton University, 1990.

[Moens and Steedman, 1988] Mark Moens and Mark Steedman. Temporal ontology and temporal reference. *Computational Linguistics, Special Issue on Tense and Aspect*, 14(2), 1988.

[Moore and Paris, 1993] Johanna D. Moore and Cécile L. Paris. Planning text for advisory dialogues: Capturing intentional and rhetorical information. *Computational Linguistics*, 19(4):651–695, 1993.

[Moore and Pollack, 1993] Johanna Moore and Martha Pollack. A Problem for RST: the Need for Multi-Level Discourse Analysis. *Computational Linguistics*, 18(4):537–544, 1993.

[Moore, 1981] Robert C. Moore. Problems in logical form. In *19th ACL Proceedings*, 1981. Also in *Readings in Natural Language Processing*, B. Grosz, K. Sparck Jones, B.L. Webber eds., Morgan Kaufmann 1986.

[Passonneau, 1988] Rebecca J. Passonneau. A Computational Model of the Semantics of Tense and Aspect. *Computational Linguistics, Special Issue on Tense and Aspect*, 14(2), 1988.

[Penstein Rosé *et al.*, 1995] Carolyn Penstein Rosé, Barbara Di Eugenio, Lori Levin, and Carol Van Ess-Dykema. Discourse processing of dialogues with multiple threads. In *Proceedings 33rd Annual Meeting of the Association for Computational Linguistics*, 1995.

[Pereira and Pollack, 1991] Fernando Pereira and Martha Pollack. Incremental Interpretation. *Artificial Intelligence*, 50:37–82, 1991.

[Perrault and Allen, 1980] Raymond Perrault and James Allen. A Plan-Based Analysis of Indirect Speech-Acts. *American Journal of Computational Linguistics*, 6:167–182, 1980.

[Polanyi, 1988] Livia Polanyi. A Formal Model of the Structure of Discourse. *Journal of Pragmatics, Special issue on Cognitive Aspects of Language Use*, 12(5-6):601–638, 1988.

[Pollack, 1990] Martha Pollack. Plans as Complex Mental Attitudes. In P. Cohen, J. Morgan, and M. Pollack, editors, *Intentions in Communication.* MIT Press, 1990.

[Prince, 1981] Ellen Prince. Toward a Taxonomy of Given-New Information. In P. Cole, editor, *Radical Pragmatics*. Academic Press, 1981.

[Pustejovsky and Boguraev, 1993] James Pustejovsky and Branimir Boguraev. Lexical knowledge representation and natural language processing. *Artificial Intelligence, Special Volume on Natural Language Processing*, 63(1–2):193–223, 1993.

[Rambow, 1993] Owen Rambow, editor. *ACL Workshop on Intentionality and Structure in Discourse Relations*, Columbus, OH, 1993.

[Resnik, 1993] Philip Resnik. Semantic Classes and Syntactic Ambiguities. In *ARPA workshop on Human Language Technology*, 1993.

[Schubert and Pelletier, 1982] Lenhart K. Schubert and Francis J. Pelletier. From English to Logic: Context-Free Computation of 'Conventional' Logical Translations. *Computational Linguistics*, 10:165–176, 1982. Also in *Readings in Natural Language Processing*, B. Grosz, K. Sparck Jones, B.L. Webber eds., Morgan Kaufmann 1986.

[Searle, 1965] John R. Searle. What Is a Speech Act. In M. Black, editor, *Philosophy in America*, pages 221–239. 1965. Reprinted in *Pragmatics. A Reader*, Steven Davis editor, Oxford University Press, 1991.

[Searle, 1975] John R. Searle. Indirect Speech Acts. In P. Cole and J.L. Morgan, editors, *Syntax and Semantics 3. Speech Acts*. Academic Press, 1975. Reprinted in *Pragmatics. A Reader*, Steven Davis editor, Oxford University Press, 1991.

[Shapiro and Rapaport, 1992] Stuart Shapiro and William Rapaport. The SNePS Family. *Computers and Mathematics with Applications, Special Issue on Semantic Networks in Artificial Intelligence, Part 1*, 23(2–5), 1992.

[Shapiro, 1992] Stuart C. Shapiro, editor. *Encyclopedia of Artificial Intelligence — Second Edition*. John Wiley and Sons, 1992.

[Shima, 1995] Kaori Shima. Anaphora Resolution in Japanese: a Centering Approach. Master's project, Carnegie Mellon University, May 1995.

[Sidner, 1983] Candace Sidner. Focusing in the comprehension of definite anaphora. In M. Brady and R.C. Berwick, editors, *Computational Models of Discourse*. MIT Press, 1983. Also in *Readings in Natural Language Processing*, B. Grosz, K. Sparck Jones, B.L. Webber eds., Morgan Kaufmann 1986.

[Soames, 1982] Scott Soames. How Presuppositions are Inherited: a Solution to the Projection Problem. *Linguistic Inquiry*, 13:483–545, 1982. Reprinted in *Pragmatics. A Reader*, Steven Davis editor, Oxford University Press, 1991.

[Sowa, 1992] John F. Sowa. Conceptual graphs as universal knowledge representation. *Computers and Mathematics with Applications, Special Issue on Semantic Networks in Artificial Intelligence, Part 1*, 23(2–5):75–93, 1992.

[Sowa, 1993] John F. Sowa. Lexical Structures and conceptual structures. In James Pustejovsky, editor, *Semantics and the Lexicon*, pages 223–262. Kluwer Academic Publishers, 1993.

[Suri and McCoy, 1994] Linda Suri and Kathleen McCoy. RAFT/RAPR and Centering: A Comparison and Discussion of Problems Related to Processing Complex Sentences. *Computational Linguistics*, 20(2), 1994.

[Turan, 1995] Ümit Deniz Turan. *Subject and Object in Turkish Discourse: a Centering Analysis*. PhD thesis, University of Pennsylvania, 1995.

[Wahlster *et al.*, 1993] Wolfgang Wahlster, Elisabeth André, Wolfgang Finkler, Hans-Juergen Profitlich, and Thomas Rist. Plan-based Integration of Natural Language and Graphics Generation. *Artificial Intelligence, Special Volume on Natural Language Processing*, 63(1–2):387–428, 1993.

[Walker *et al.*, 1994] Marilyn Walker, Masayo Iida, and Sharon Cote. Japanese Discourse and the Process of Centering. *Computational Linguistics*, 20(2):193–231, 1994.

[Walker, 1989] Marilyn Walker. Evaluating discourse processing algorithms. In *Proc. 27th Meeting, Association for Computational Linguistics*, pages 251–261, 1989.

[Walker, 1996] Marylyn A. Walker. Limited Attention and Discourse Structure. *Computational Linguistics*, 22(1), 1996.

[Webber, 1983] Bonnie Lynn Webber. So what can we talk about now? In M. Brady and R.C. Berwick, editors, *Computational Models of Discourse*. MIT Press, 1983. Also in *Readings in Natural Language Processing*, B. Grosz, K. Sparck Jones, B.L. Webber eds., Morgan Kaufmann 1986.

[Webber, 1988] Bonnie Lynn Webber. Tense as discourse anaphor. *Computational Linguistics, Special Issue on Tense and Aspect*, 14(2), 1988.

[Webber, 1991] Bonnie Lynn Webber. Structure and Ostension in the Interpretation of Discourse Deixis. *Language and Cognitive Processes*, 6(2):107–135, 1991.

[Wilks and Fass, 1992] Yorick Wilks and Dan Fass. The Preference Semantics Family. *Computers and Mathematics with Applications, Special Issue on Semantic Networks in Artificial Intelligence, Part 1*, 23(2–5), 1992.

[Wilks, 1992] Yorick Wilks. Review of 'Semantic Structures' by Ray Jackendoff. *Computational Linguistics*, 18(1):95–97, 1992.