The Dictionary Parsing Project: Steps Toward a Lexicographer's Workstation

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Dictionary Parsing Project

Purpose: to create publicly available semantic networks and ontologies based on parsing dictionary definitions

http://www.clres.com/dpp.html

Participants

- **CL Research (Ken Litkowski)**
  - Use of CL Research's DIMAP (DIctionary MAintenance Programs) to maintain dictionaries, parse definitions, and analyze parse results, inventories of semantic relations
- **USC Information Sciences Institute (Eduard Hovy, Bruce Jakeway)**
  - Conversion of raw files, development of Perl scripts, ontology building, chunking data
- **Micra, Inc. (Pat Cassidy)**
  - Preparation of raw data from Webster's Revised Unabridged Dictionary (1913), updating files, importing WordNet data for more current words
- **Franklin Electronic Publishers, Inc. (Ned Irons)**
  - Development of parser, porting to different platforms
- **Many advisors from computational lexicology and lexicography**
  - Experience from previous MRD research, identification of defining patterns for semantic relations

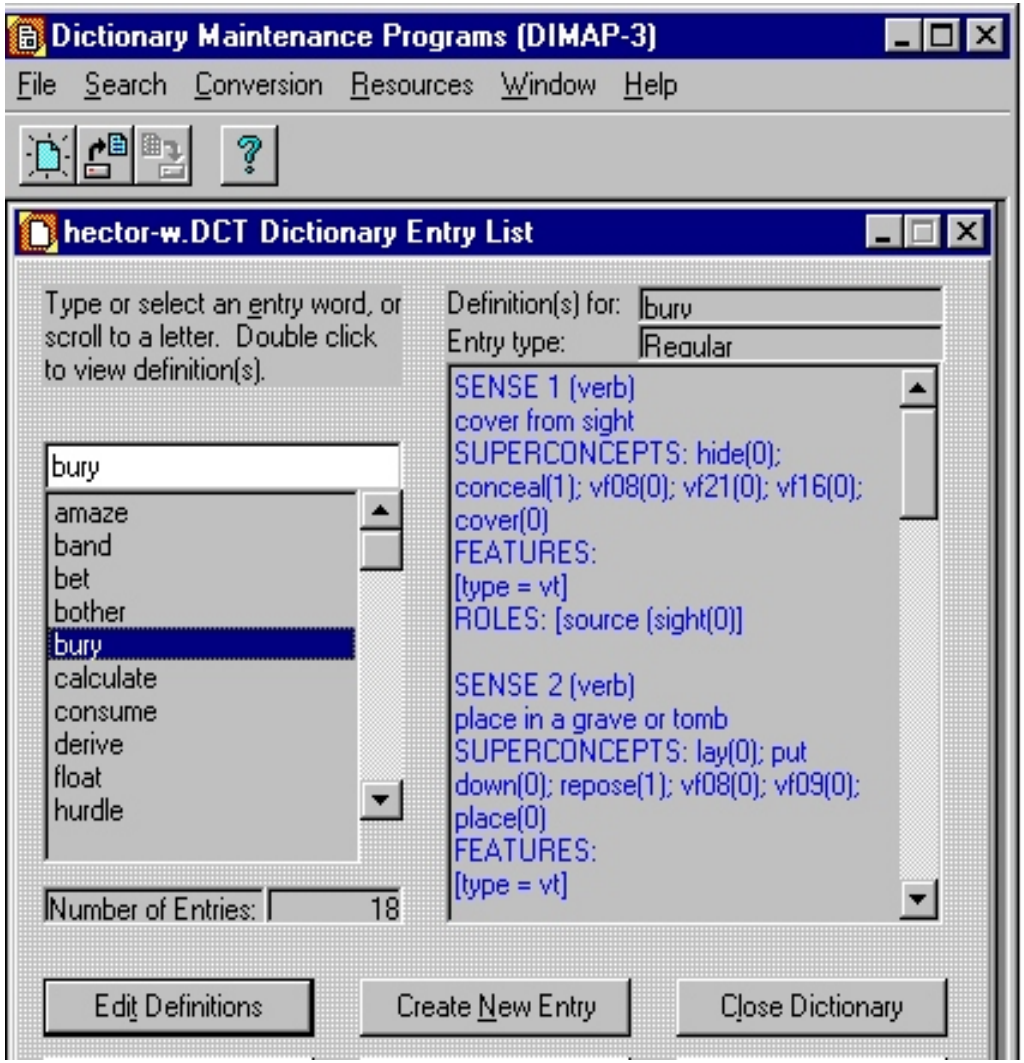
Franklin Sentence Parsing Program

- **ATN-style grammar with 350 productions:**
  - start state, condition for transition, end state (with action functions to produce parse tree nodes and annotations)
  - adds parsing goals dynamically based on subcategorization patterns for lexical entries
  - parsing dictionary based on Oxford Advanced Learner's Dictionary (4th ed.)
- **Parsing dictionary is easily extensible (currently exploring acquisition of lexical properties on the fly)**
- **Parses 400 definitions or 100 sentences per minute on 266 Mhz Pentium II with 64 MB RAM**
- **C source code available upon request (possible GNU GPL)**
  - compiles under Visual C++ 6.0, Borland C++ Builder3, Linux, BSD Unix, Sun4
  - 120 pages of documentation
- **Used by CL Research in Senseval (All-words category)**
  - 68% precision, 67% recall at coarse-grained level (highest)
  - Best overall improvement over baseline among all systems

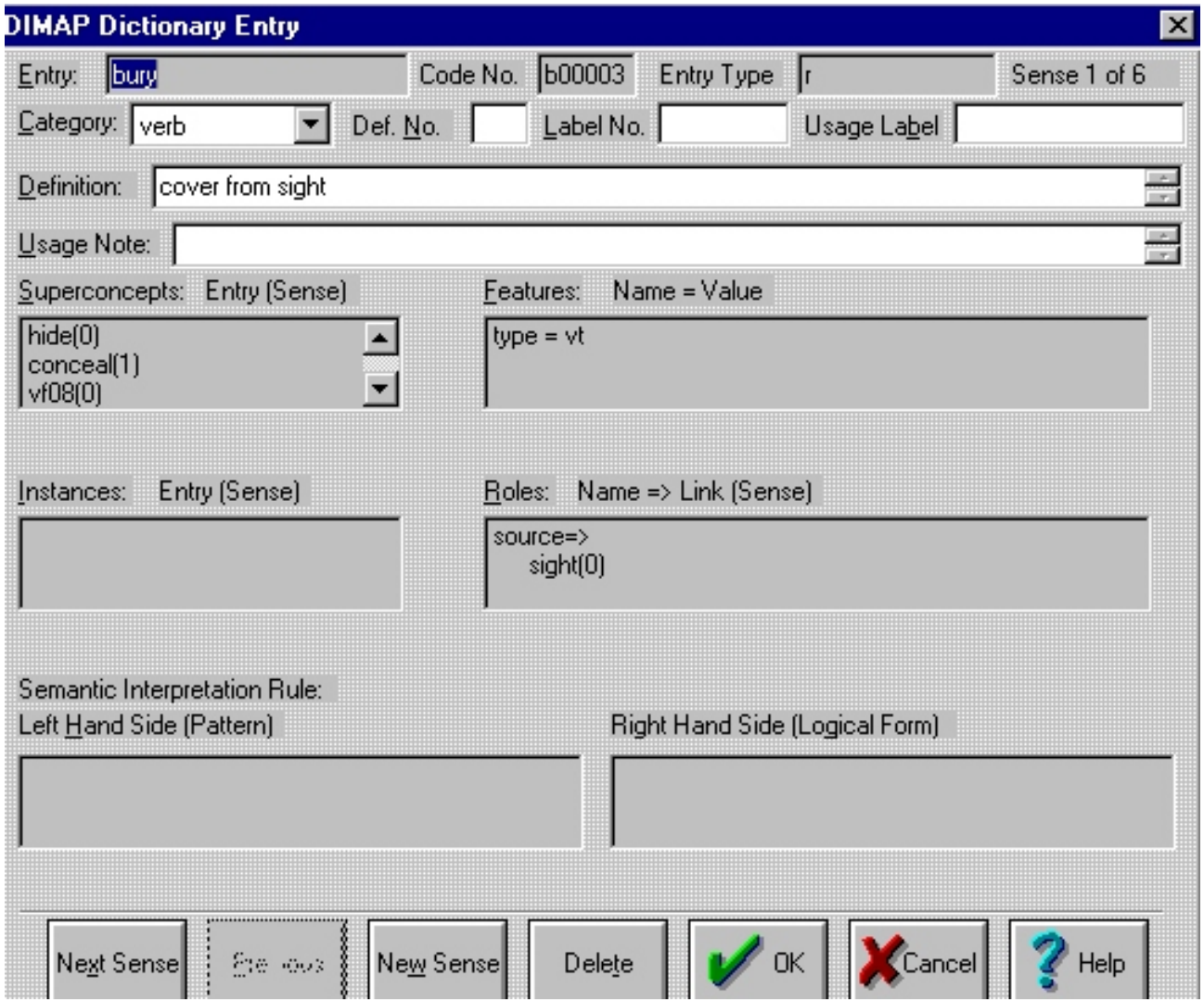
CL Research DIMAP (Dictionary Maintenance Programs)

- **NLP dictionary creation and maintenance**
  - **Usual Windows file functionality, with additional dictionary merging, subdictionary creation, uploading other dictionaries, converting DIMAP dictionaries to LISP, Prolog, or user-defined formats**
  - **Automatic creation of subdictionaries from integrated MRD or WordNet or identification of open compounds or capitalized phrases**
- **Flexible underlying data structure for entries**
  - **Multiple senses, each with usual paper dictionary data (definitions, usage notes, etc) and special fields for hypernyms, hyponyms, AV feature structures, semantic roles, semantic interpretation rules**
- **Definition analysis functionality**
  - **Parsing definitions, comparing definitions across dictionaries, examining inheritance hierarchies, regular expression searches on all fields, identifying semantic primitives using graph-theoretic model**
- **Integrated text parsing**

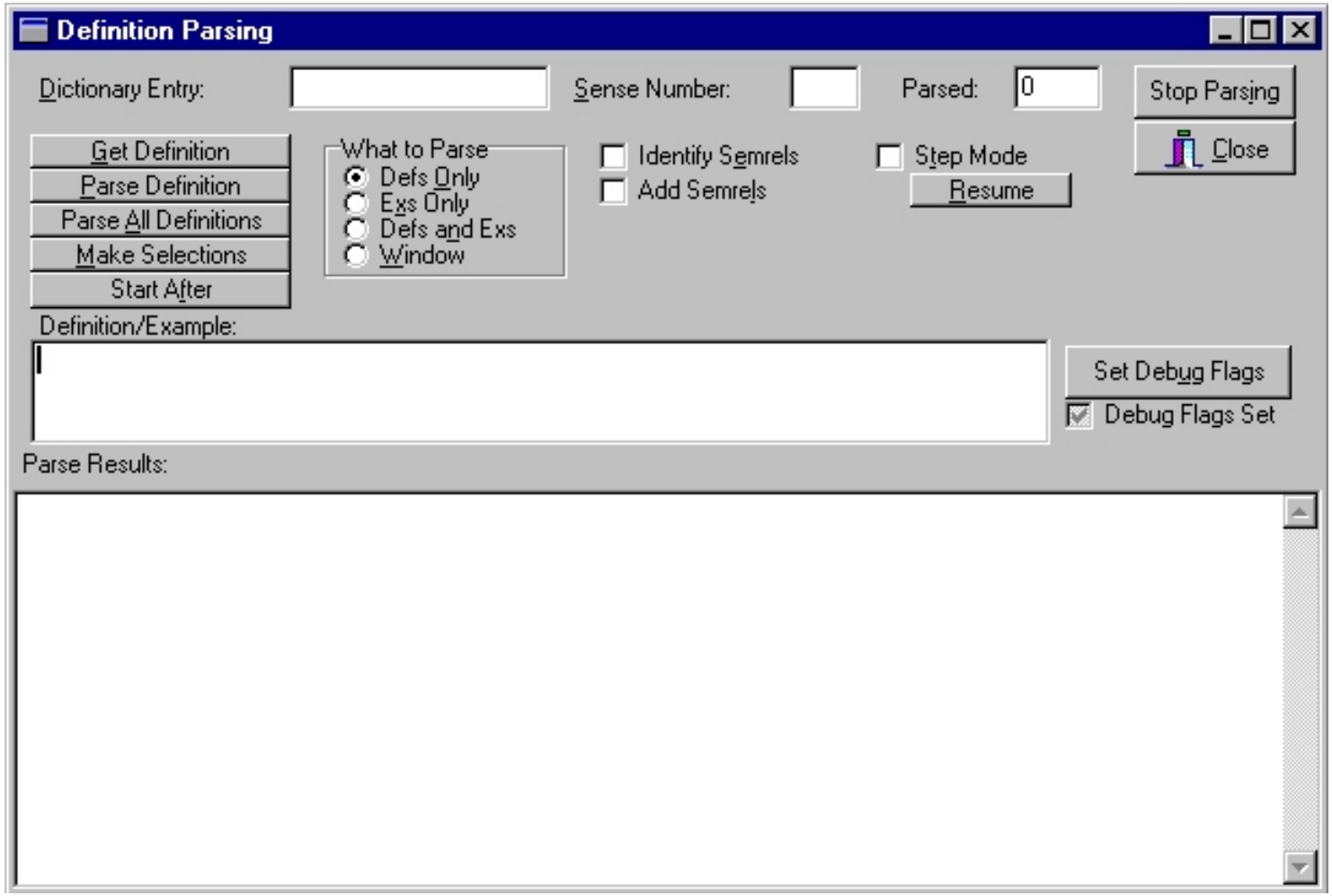
DIMAP Dictionary



DIMAP Dictionary Entry

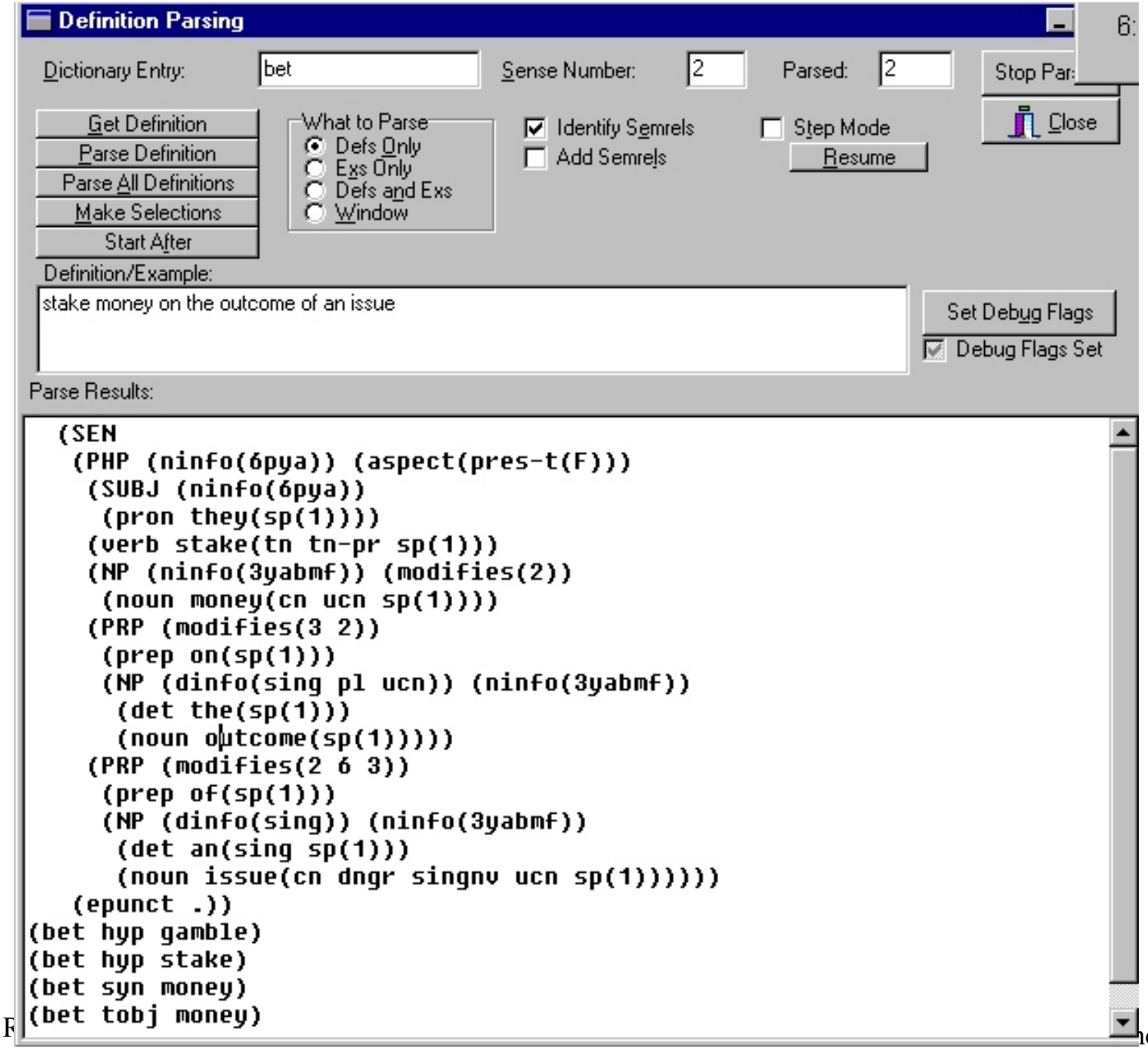


Definition Parsing



Definition Parsing Process

- **Definitions placed into sentence frames appropriate to the part of speech, with special consideration given to selectional restrictions (usually parenthesized structures), usage notes (”used with *up*”), and specialized wording (”typically”, “usually”, “to a specified condition”)**
- **Parse results (annotated parse tree) analyzed to identify extract hypernyms, synonyms, and other semantic relations (semrels)**
- **Use of defining patterns (e.g., manner: in(dpat((~ rep01(det(0)) adj manner(0) sr(manner)))) to identify semrels (hyernym, synonym, instrument, means, location, purpose, source, manner, has-constituents, has-members, is-part-of, locale, and goal)**
- **Identified semrels are placed in dictionary being parsed, where they are then available for subsequent analysis built into DIMAP functionality**
- **400 definitions per minute on a 266 MHz Pentium II with 64 MB RAM**


Definition Parsing
Dictionary Entry:
bet
Sense Number:
2
Parsed:
2
Stop Par:
Get Definition
Parse Definition
Parse All Definitions
Make Selections
Start After
What to Parse
Defs Only
Exs Only
Defs and Exs
Window
Identify Semrels
Add Semrels
Step Mode
Resume
Close
Definition/Example:
stake money on the outcome of an issue
Set Debug Flags
Debug Flags Set
Parse Results:
(SEN
(PHP (ninfo(6pya)) (aspect(pres-t(F)))
(SUBJ (ninfo(6pya))
(pron they(sp(1))))
(verb stake(tn tn-pr sp(1)))
(NP (ninfo(3yabmf)) (modifies(2))
(noun money(cn ucn sp(1))))
(PRP (modifies(3 2))
(prep on(sp(1)))
(NP (dinfo(sing pl ucn)) (ninfo(3yabmf))
(det the(sp(1)))
(noun outcome(sp(1)))))
(PRP (modifies(2 6 3))
(prep of(sp(1)))
(NP (dinfo(sing)) (ninfo(3yabmf))
(det an(sing sp(1)))
(noun issue(cn dngr singnv ucn sp(1))))))
(epunct .))
(bet hyp gamble)
(bet hyp stake)
(bet syn money)
(bet tobj money)

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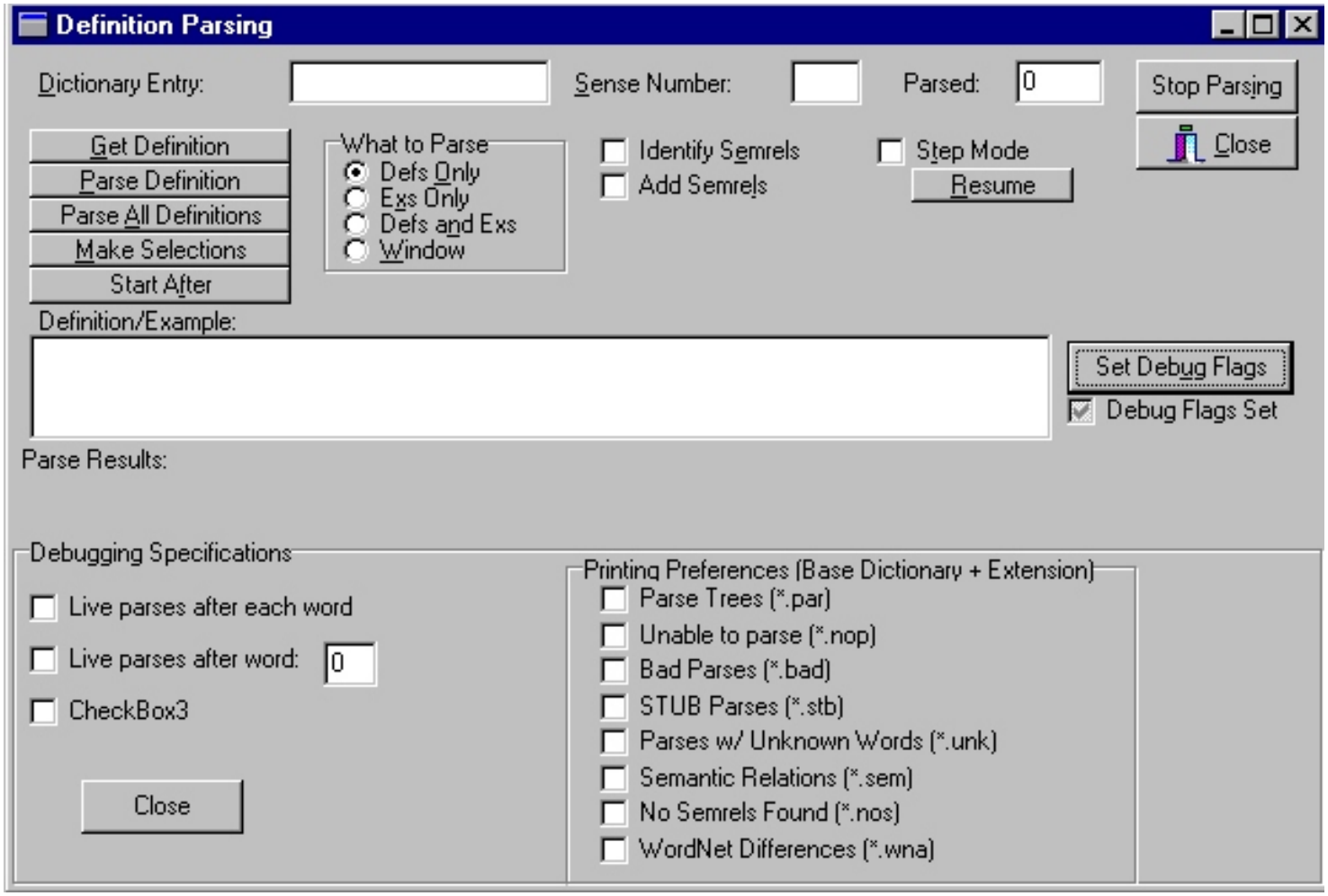
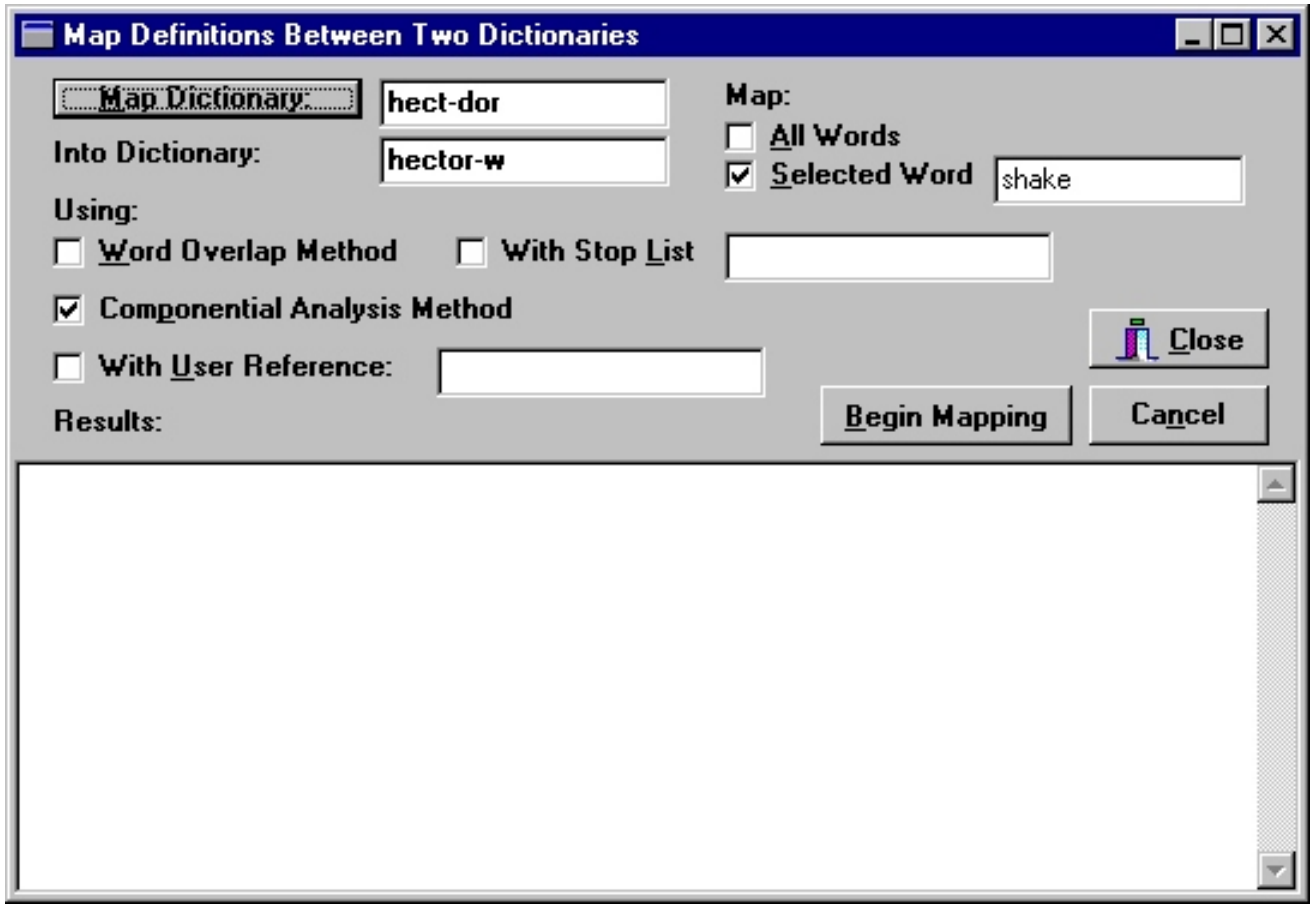
Examination of Parsing Results

- **Examination of parsing results to make corrections to parsing system**
  - **Identifying parser problems**
  - **Identifying words unknown to the parser**
- **Listing identified semrels**
- **Identifying senses where no semrels were found**
- **Performing consistency analysis against WordNet (e.g., do hypernyms found from parsing match WordNet hypernyms)**
- **Definition comparison (mapping between two dictionaries), using word overlap or componential analysis method (see Litkowski, SIGLEX99)**
- **Analysis of dictionary digraph to identify primitives (based on ISA links)**

Lexicographer Functionality

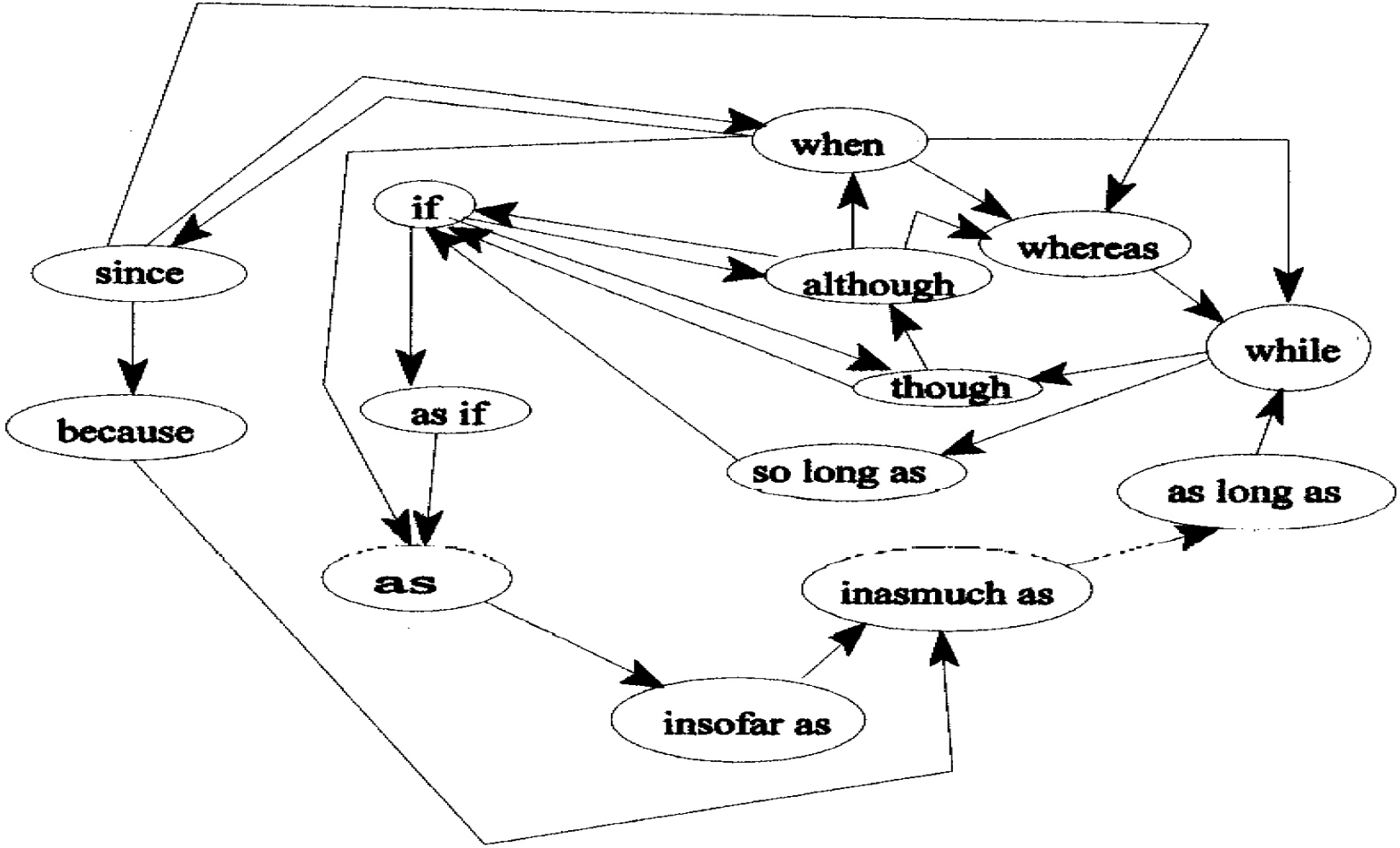


Definition Comparison



Digraph of Primitive Subordinating Conjunctions

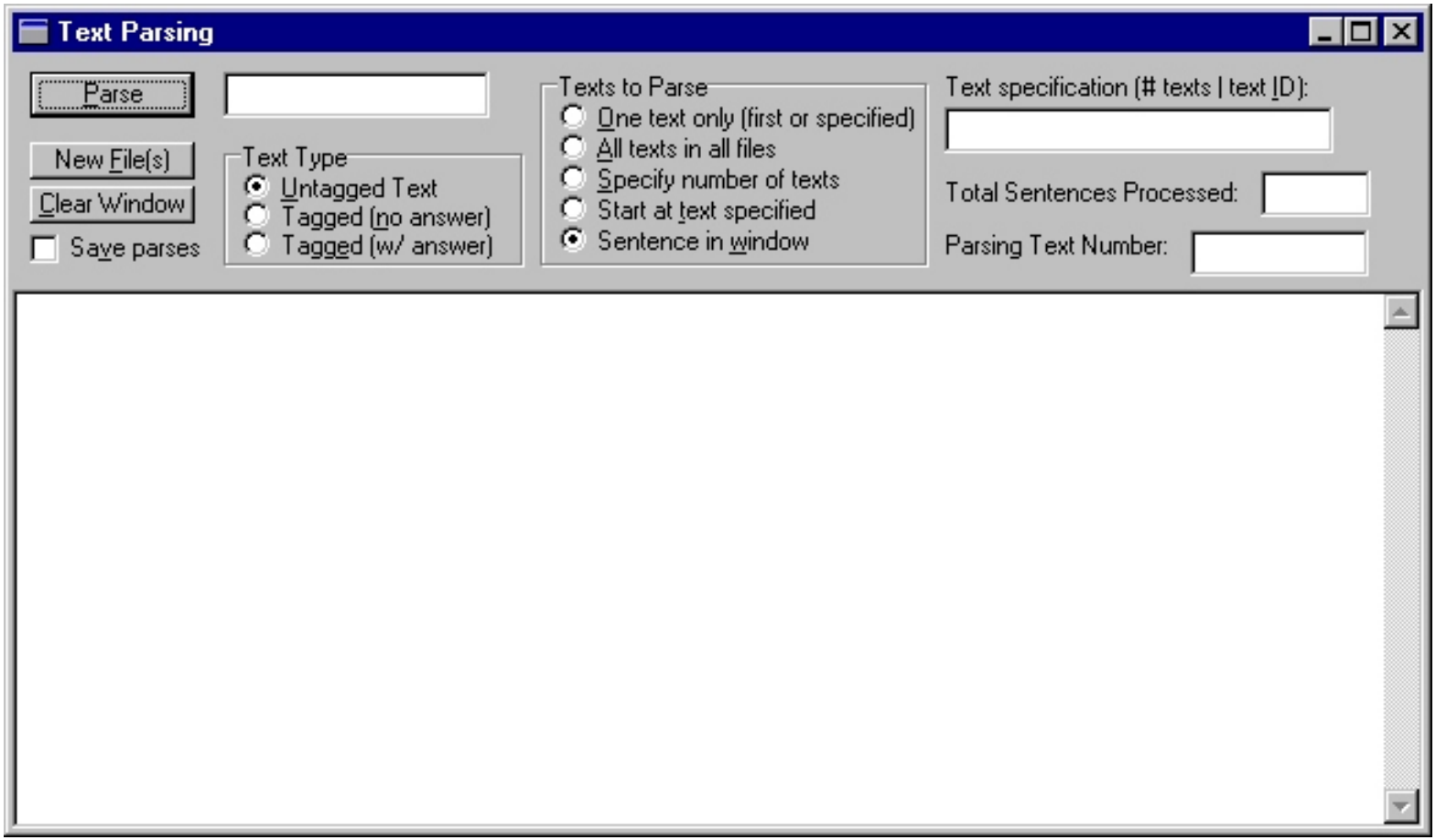
Figure 2: Dominant Subordinating Conjunction Strong Component



Testing Dictionary Entries (Word- Sense Disambiguation)

- **Given a corpus sample, how well does characterization of current sense set (including identified semrels) allow WSD**
- **Use SENSEVAL model (with target words tagged or untagged)**
- **Examine individual sentences or entire corpora**
- **Accompanying scoring program to determine effect of improvements**
- **90 sentences per minute on a 266 MHz Pentium II with 64 MB RAM**

Testing Corpus Instances (Senseval)



DPP Status

- **Parsing definitions to build semantic network (like thesaurus or MindNet) automatically (0.86 semrels per sense, compared to 3.26 for MindNet)**
- **Identifying backbone of hierarchy with genus terms and part-of relations**
- **Filling in details of network with many types of semantic relations, conceptually oriented, including purpose, means, manner, source, destination, locale and location**
- **Ability to map categories, concepts, or definitions between dictionaries and ontologies based on parsing their descriptions**
  - **(”if it quacks like a duck, moves like a duck, has the parts of a duck, chances are that it’s a duck”)**
- **Inventories of semantic relations (UMLS, WordNet, EuroWordNet, Micra, Wordsmyth, Webster’s 3rd prepositions)**