

Computational Intelligence 696i

Language

Lecture 6

Sandiway Fong

Administriva

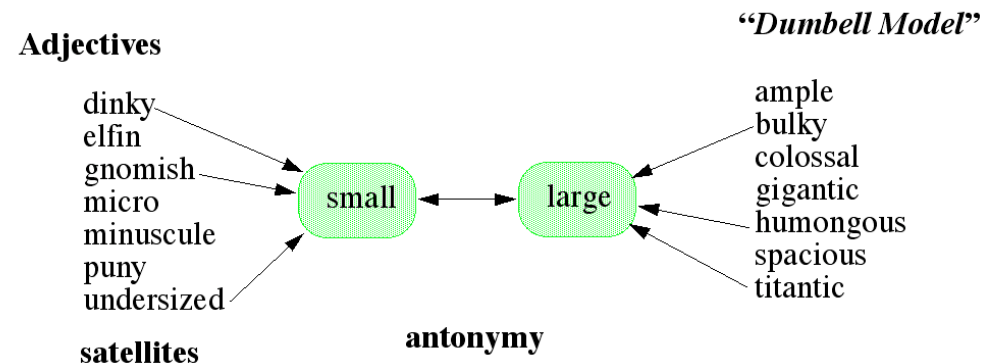
- Reminder:
 - Homework 1 due today (*midnight*)
 - Homework 2 discussed today
 - due in one week (*next Tuesday midnight*)
 - submit to sandiway@email.arizona.edu

Administriva


- <http://dingo.sbs.arizona.edu/~sandiway/wnconnect/>
- **Graphical User Interface Versions (GUI):**
 - As a Mac OS X application (**wnconnect**)
 - As a Windows application
 - As a Linux application
- **Text-based User Interface Versions:**
 - *run under a (free) Prolog interpreter*
 - As Prolog software compiled for Windows (SWI-Prolog)
 - As platform-independent Prolog software (**prologwn**) without a GUI

Last Time

- **semantic networks based around language**
 - **WordNet** (Miller @ Princeton University)
 - handbuilt (*ad hoc*) network of synonym sets (**synsets**) connected by semantic relations
 - e.g. isa, part of, antonymy, causation etc.
- **large-scale (and free) lexical resource**
 - 139,000 entries (**word senses**) v1.7
 - 10,000 verbs (polysemy 2)
 - 20,000 adjectives (1.5)

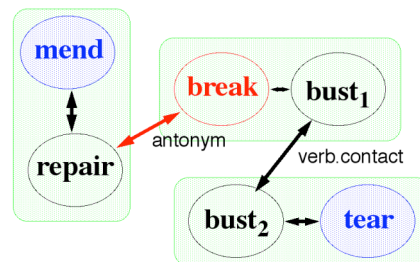


Last Time

- **semantic networks based around language**
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 - e.g. isa, part of, antonymy, causation etc.
- **Example (*Semantic Opposition*):**
 - an instance of the **frame problem**
 - John mended the **torn/red** dress
 - **mend**: x CAUS y BECOME <STATE (**mended**)>
 - John CAUS the **torn/red** dress BECOME <STATE (**mended**)>
 - **antonym** relation between adjective and the end state

Semantic Opposition

- *Event-based Models of Change and Persistence in Language* (Pustejovsky, 2000):
 - John mended the **torn** dress
 - John mended the **red** dress
- what kind of knowledge is invoked here?
 - *can exploit the network*



- or
- *GL Model*
 - *Generative Lexicon* (Pustejovsky 1995)

Two Problems

- *linguistically relevant puzzles*
- *outside syntax*

1. Semantic Opposition
- 2. Logical Metonymy**

Logical Metonymy

- *also can be thought of an example of gap filling*
- *with **eventive verbs**: begin and enjoy*
- Pustejovsky (1995), Lascarides & Copestake (1995) and Verspoor (1997)

- **Examples:**

- John began the novel *(reading/writing)*
- John began [reading/writing] the novel
- X began Y \Rightarrow X began **V-ing** Y

- The author began the unfinished novel back in 1962 *(writing)*
- The author began [writing] the unfinished novel back in 1962

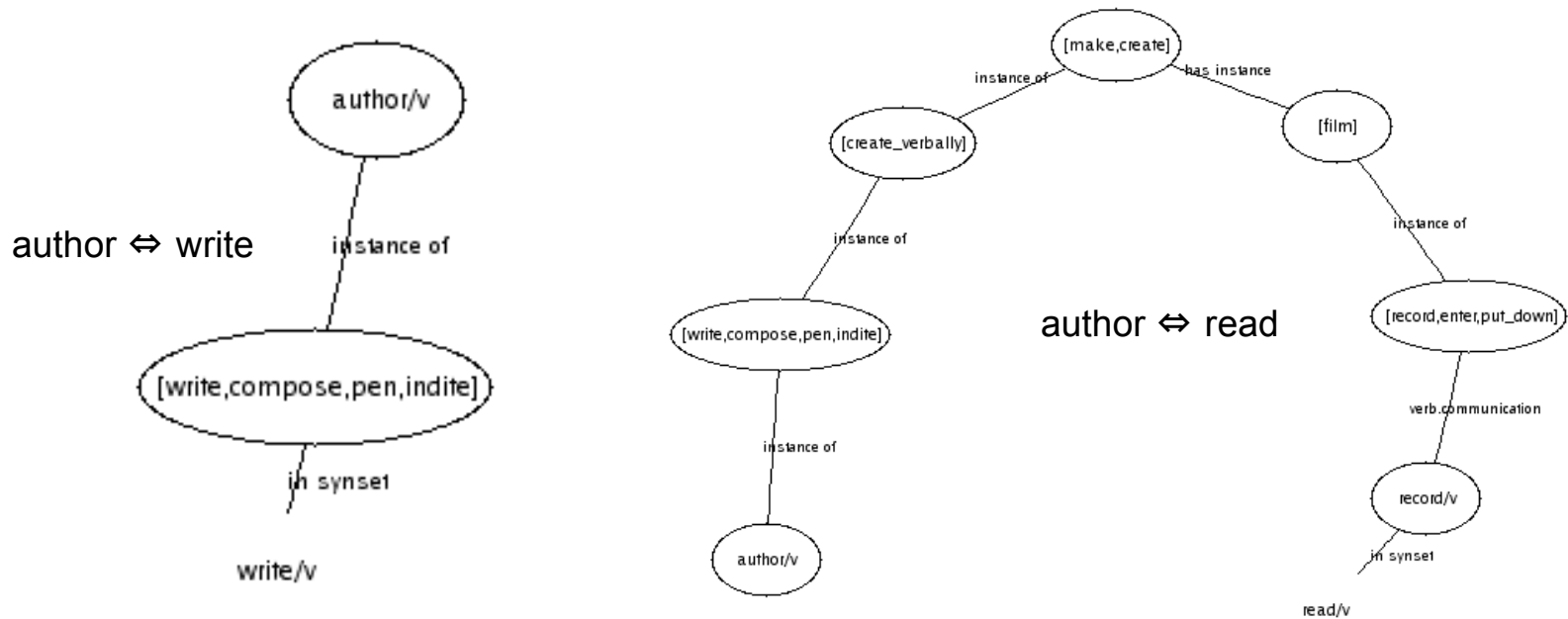
Logical Metonymy

- *also can be thought of an example of gap filling ...*
- Pustejovsky (1995), Lascarides & Copestake (1995) and Verspoor (1997)
- **eventive verbs:** *begin* and *enjoy*
- **Examples:**
 - John began the novel (reading/writing)
 - The author began the unfinished novel back in 1962 (writing)
- **One idea about the organization of the lexicon (GL):**
 - *novel*: **qualia structure**:
 - **telic role:** *read* (purpose/function)
 - **agentive role:** *writing* (creation)
 - **constitutive role:** narrative (parts)
 - **formal role:** book, disk (physical properties)

Logical Metonymy

- **Examples:**

- John began the novel (reading/writing)
- The author began the unfinished novel back in 1962 (writing)



Logical Metonymy

- **Examples:**

- John began the novel *(reading/writing)*
- The author began the unfinished novel back in 1962 *(writing)*

- **More Examples:** *(enjoy)*

- Mary enjoyed [reading] the novel *(reading)*
- !!The visitor enjoyed [verb] the door *(?telic role)*
- Mary enjoyed [seeing] the garden *(seeing...)*

Logical Metonymy

- **Multiple telic roles:**

- Mary enjoyed [seeing] the garden (seeing)
- Mary enjoyed **inspecting** the garden
- Mary enjoyed **visiting** the garden
- Mary enjoyed **strolling** through the garden
- Mary enjoyed **rollerblading** in the garden
- Mary enjoyed **sitting** in the garden
- Mary enjoyed **dozing** in the garden

Logical Metonymy

- **easily defeasible:**

- He really enjoyed your book (*reading*)
- He really enjoyed [reading] your book
-
- My goat eats anything.
- He really enjoyed [verb] your book (*reading*)
- (*eating*)

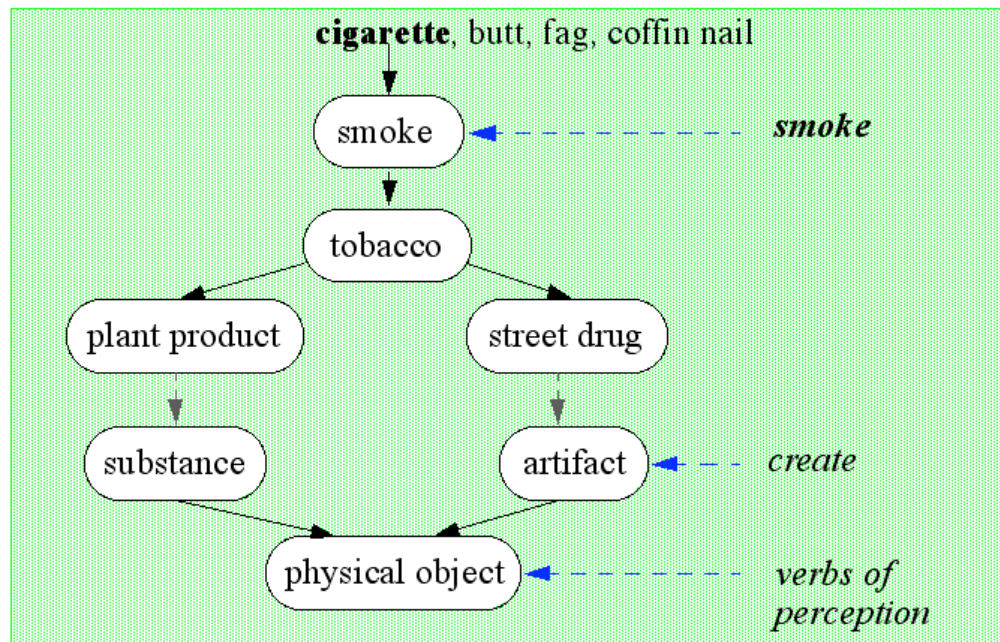
Logical Metonymy

- **easily defeasible:**
 - My dog eats everything.
 - !He really enjoyed [verb] your shoe (*eating*)
- very different in character from the other gap-filling examples we've seen:
 - ***not defeasible***
 - John is too stubborn [someone] to talk to [John]
 - John is too stubborn [John] to talk to Bill

WordNet and Telic Role Computation

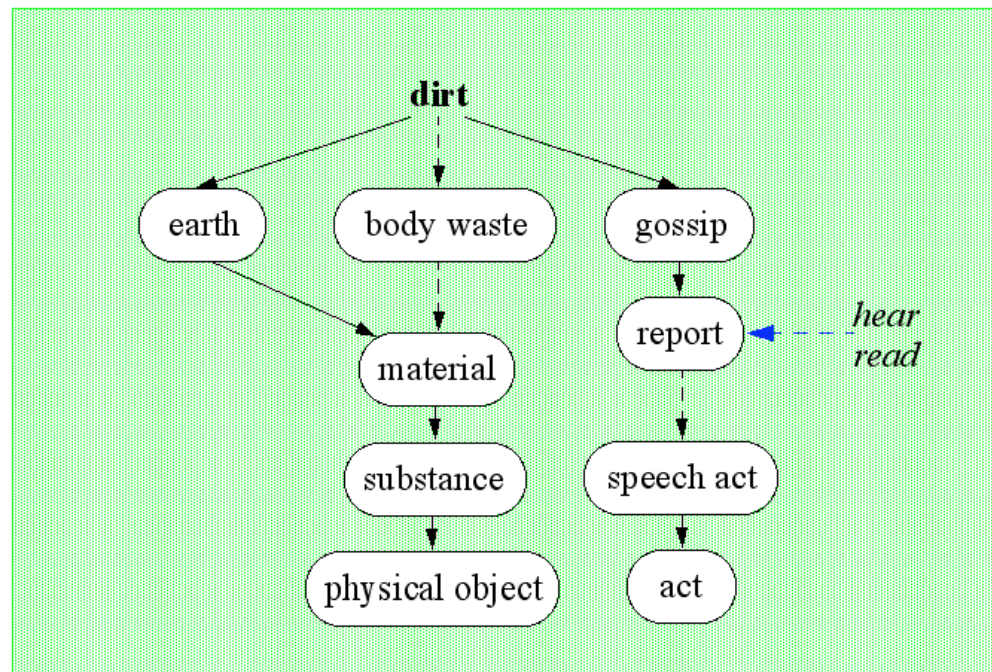
- **Example:**

- John enjoyed [verb] the cigarette (*smoking*)



WordNet and Telic Role Computation

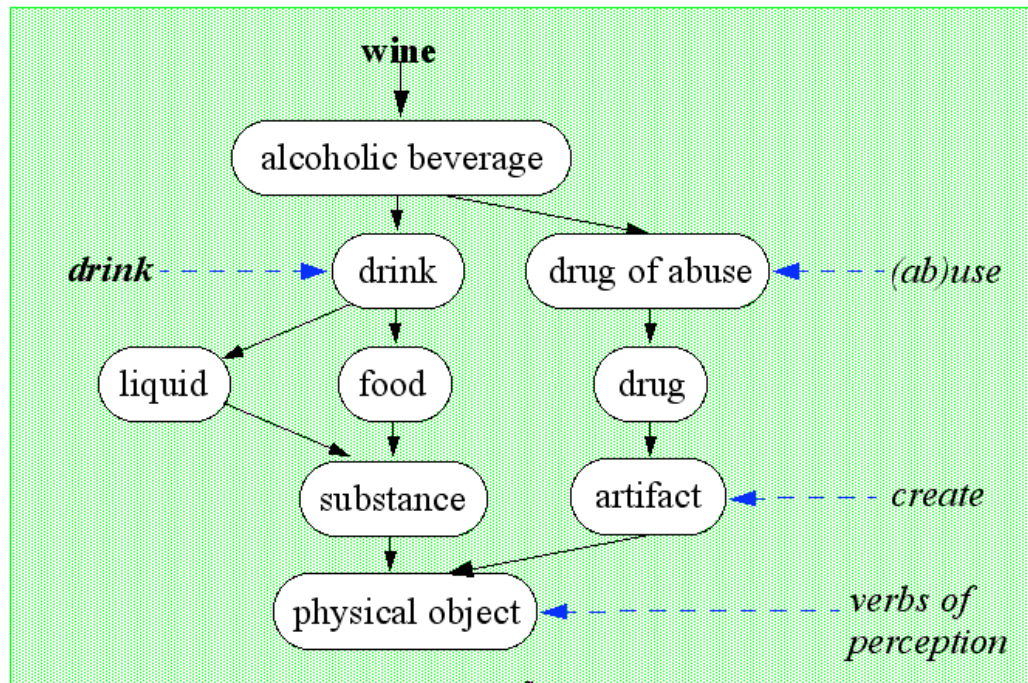
- **Example:**
 - !John enjoyed [verb] the dirt (*?telic role*)



WordNet and Telic Role Computation

- **Example:**

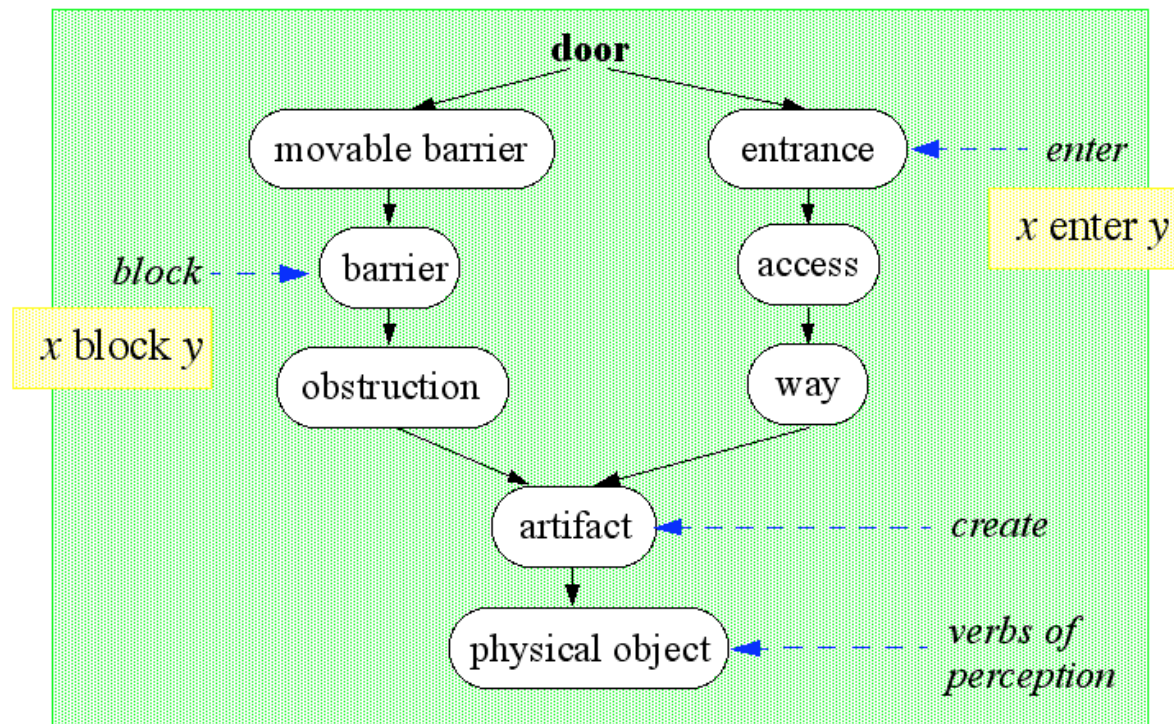
- !John enjoyed [verb] the wine (drinking)



WordNet and Telic Role Computation

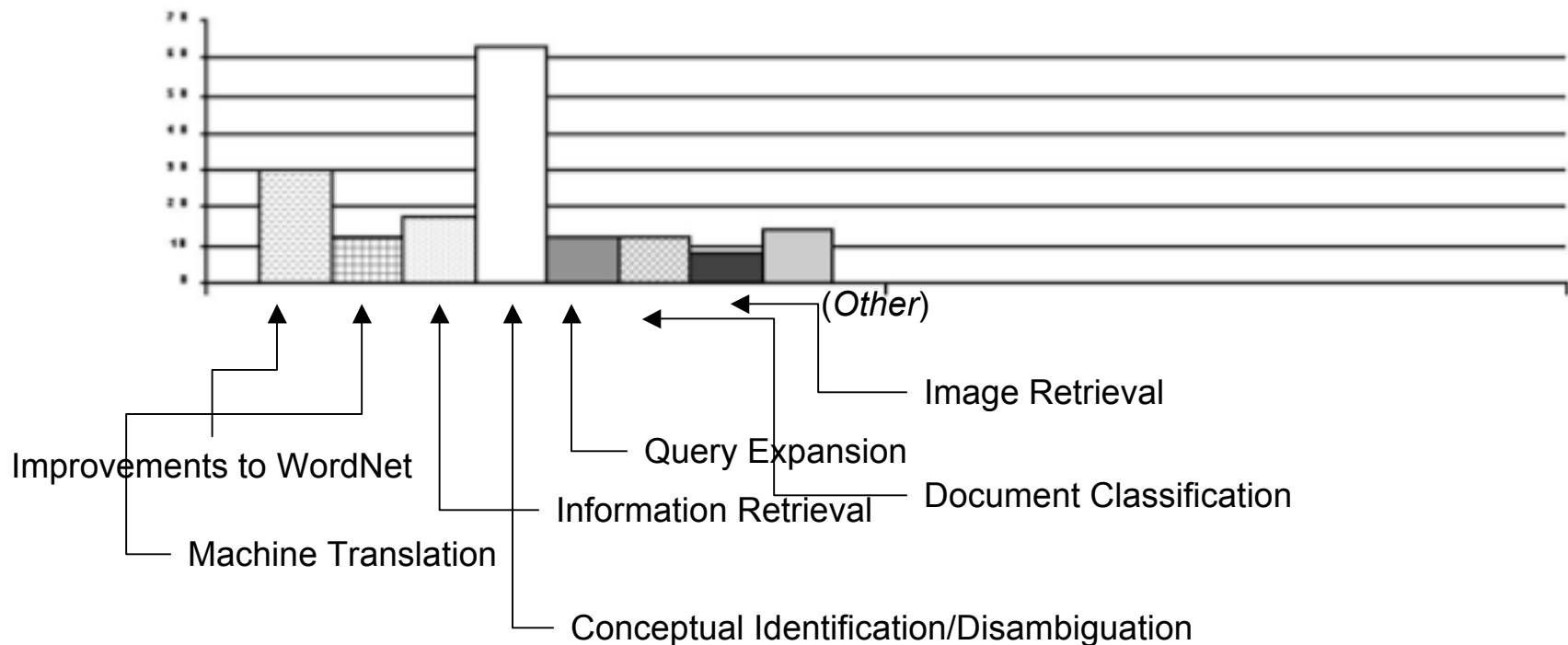
- **Example:**

– !John enjoyed [verb] the door (telic role)



WordNet Applications

- WordNet Applications. Morato et al. In Proceedings of the GWC 2004, pp. 270–278.



WordNet Applications

- Examples:
 - Information retrieval and extraction
 - query term expansion (synonyms etc.)
 - cross-linguistic information retrieval (multilingual WordNet)
 - Concept identification in natural language
 - word sense disambiguation
 - WordNet senses and ontology (*isa*-hierarchy)
 - Semantic distance computation
 - relatedness of words
 - Document structuring and categorization
 - determine genre of a paper (WordNet verb categories)

Homework 2

GRE

- Educational Testing Service (ETS)
 - www.ets.org
 - 13 million standardized tests/year
 - Graduate Record Examination (GRE)
- verbal section of the GRE
 - vocabulary
- GRE vocabulary
 - word list
- Word list retention
 - word matching exercise (*from a GRE prep book*)
 - homework 2

Task: Match each word in the first column with its definition in the second column

accolade

aberrant

abate

abscond

acumen

acerbic

abscission

accretion

abjure

abrogate

deviating

keen insight

abolish

lessen in intensity

sour or bitter

depart secretly

building up

renounce

removal

praise

Homework 2

- *(for 10 pts)*
- use **WordNet** to “solve” the word match puzzle
- come up with an algorithm or procedure that produces a good assignment for words in the left column to those on the right
 - minimum threshold for acceptable algorithms: 9/10 right
- describe your algorithm and show in detail how it works on the given example
- *(you could but you don't have to turn in a program)*

Task: Match each word in the first column with its definition in the second column

accolade

aberrant

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acerbic

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accretion

abjure

abrogate

deviation

keen **insight**

abolish

lessen in intensity

sour or bitter

depart secretly

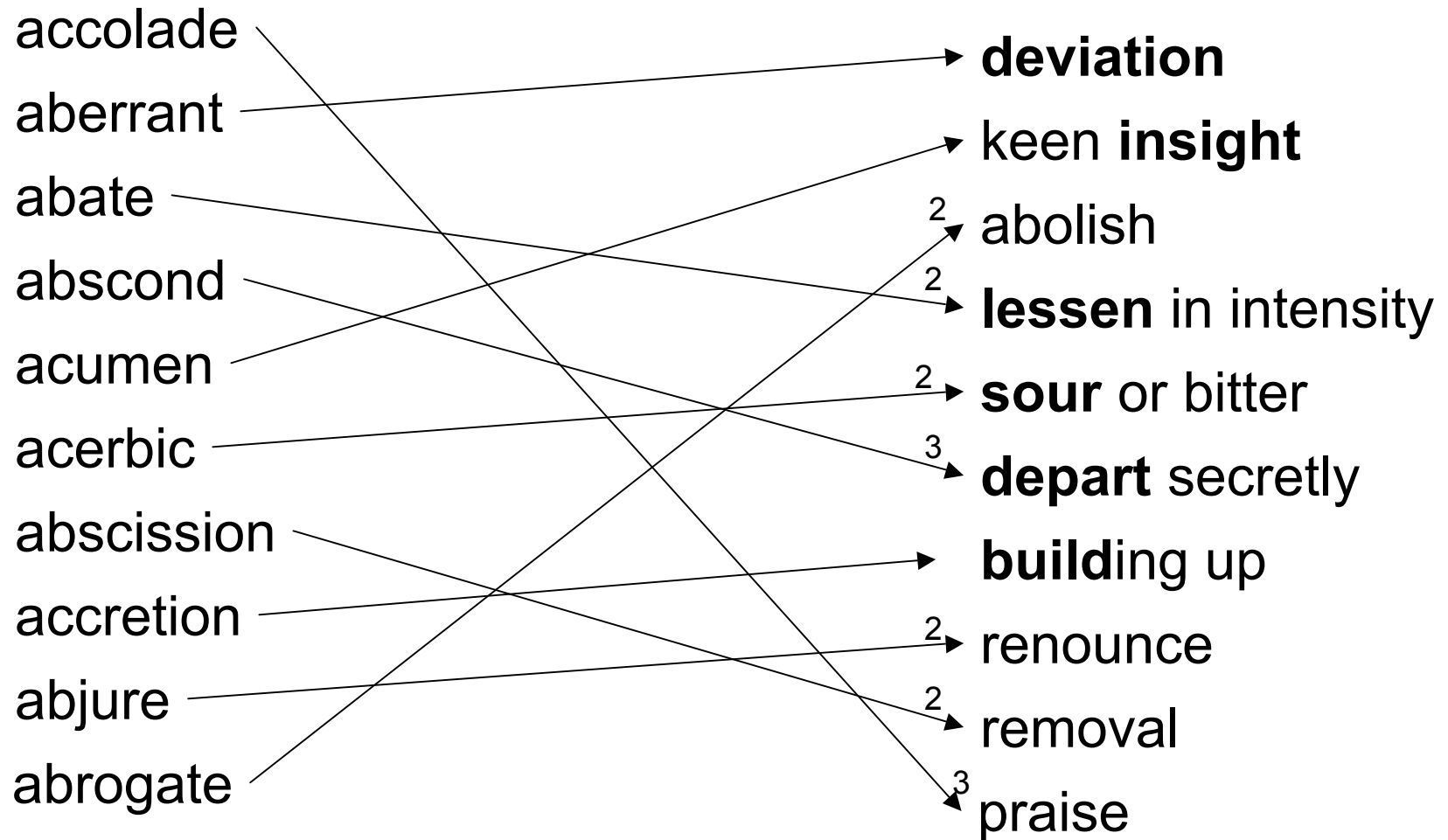
building up

renounce

removal

praise

Task: Match each word in the first column with its definition in the second column



Discussion



Language and Intelligence

- if a computer program can be written to do as well as humans on the GRE test, is the program *intelligent*?
- Can such a program be written?
 - Math part: no problem
 - Verbal part: *tougher, but parts can be done right now...*
 - **homework 2**
 - analogies
 - antonyms
 - **two essay sections**
 - (Issue-Perspective, Argument-Analysis)

Interesting things to Google™



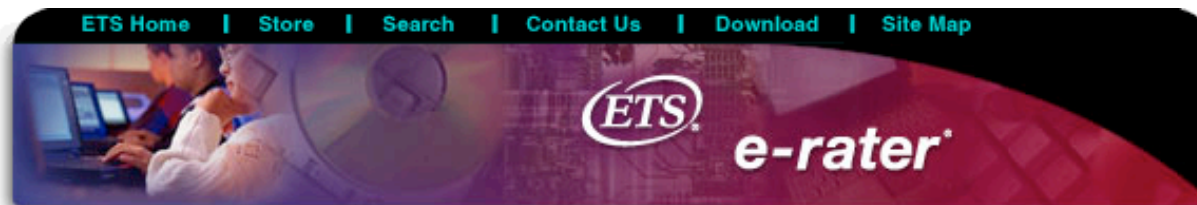
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- www.ets.org/erater/index.html



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Get instant feedback on essay writing performance!

E-rater scores a word-processed essay within seconds! Developed at ETS and grounded in more than a decade of research, e-rater is designed to score essays based on an analysis of writing features as reflected in holistic scoring rubrics.

Proven highly effective and accurate, e-rater has provided scores for millions of examinee responses to essay questions. The e-rater scoring engine powers [Criterion Online Writing Evaluation](#), ETS's innovative placement, assessment, and instructional tool, and [ScoreItNow!](#)

Score accuracy: 98% agreement with trained readers

Proven highly effective and accurate, e-rater has provided one of the two scores for nearly 2 million examinee responses to essay questions administered as part of the Graduate Management Admissions Test (GMAT). The agreement rate between e-rater and expert faculty readers on GMAT essays consistently exceeds 98 percent.

Interesting things to Google™

- e-rater FAQs
- Q. What's the technology used in e-rater?
 - e-rater uses NLP to identify the features of the faculty-scored essays in its sample collection and store them-with their associated weights-in a database.
 - When e-rater evaluates a new essay, it compares its features to those in the database in order to assign a score.
 - Because e-rater **is not doing any actual reading**, the validity of its scoring depends on the scoring of the sample essays from which e-rater 's database is created.

Interesting things to Google™

- **e-rater FAQs**
- **Q. How often does the computer's score agree with the score of a faculty reader?**
 - Almost all the time.
 - ETS researchers found exact agreement, or a difference of only one point, in as many as 98 percent of the comparisons between the computer's scores and those of a trained essay-reader using the same scoring guides and scoring system.

Interesting things to Google™

- **e-rater FAQs**
- **Q. How do students feel about being scored by a machine?**
 - Most of today's students have had experience with instant feedback in computer programs and are becoming more comfortable with the idea of computerized scoring.

Interesting things to Google™

- <http://www.ets.org/research/dload/iaai03bursteinj.pdf>
- CriterionSM: Online essay evaluation: An application for automated evaluation of student essays.
 - Burstein, J., Chodorow, M., & Leacock, C. (2003)
 - *In Proceedings of the Fifteenth Annual Conference on Innovative Applications of Artificial Intelligence*, Acapulco, Mexico.
 - (This paper received an AAAI Deployed Application Award.)
- e-rater:
 - trained on 270 essays scored by human readers
 - evaluates syntactic variety, discourse, topical content, lexical complexity
 - 50 features
- critique:
 - grammar checker (agreement, verb formation, punctuation, typographical errors)
 - bigram model of English

Interesting things to Google™

- ... *recent news on automated bogus paper generation*
- <http://pdos.csail.mit.edu/scigen/>
- **SCIgen - An Automatic CS Paper Generator**
 - SCIgen is a program that generates random Computer Science research papers, including graphs, figures, and citations. It uses a hand-written **context-free grammar** to form all elements of the papers.
- **Achievements:**
 - one out of two papers got accepted at the World Multiconference on Systemics, Cybernetics and Informatics (WMSCI)
 - Rooter: A Methodology for the Typical Unification of Access Points and Redundancy
 - **“We implemented our scatter/ gather I/O server in Simula-67, augmented with opportunistically pipelined extensions.”**