The SPECIALIST Lexicon and NLP Tools

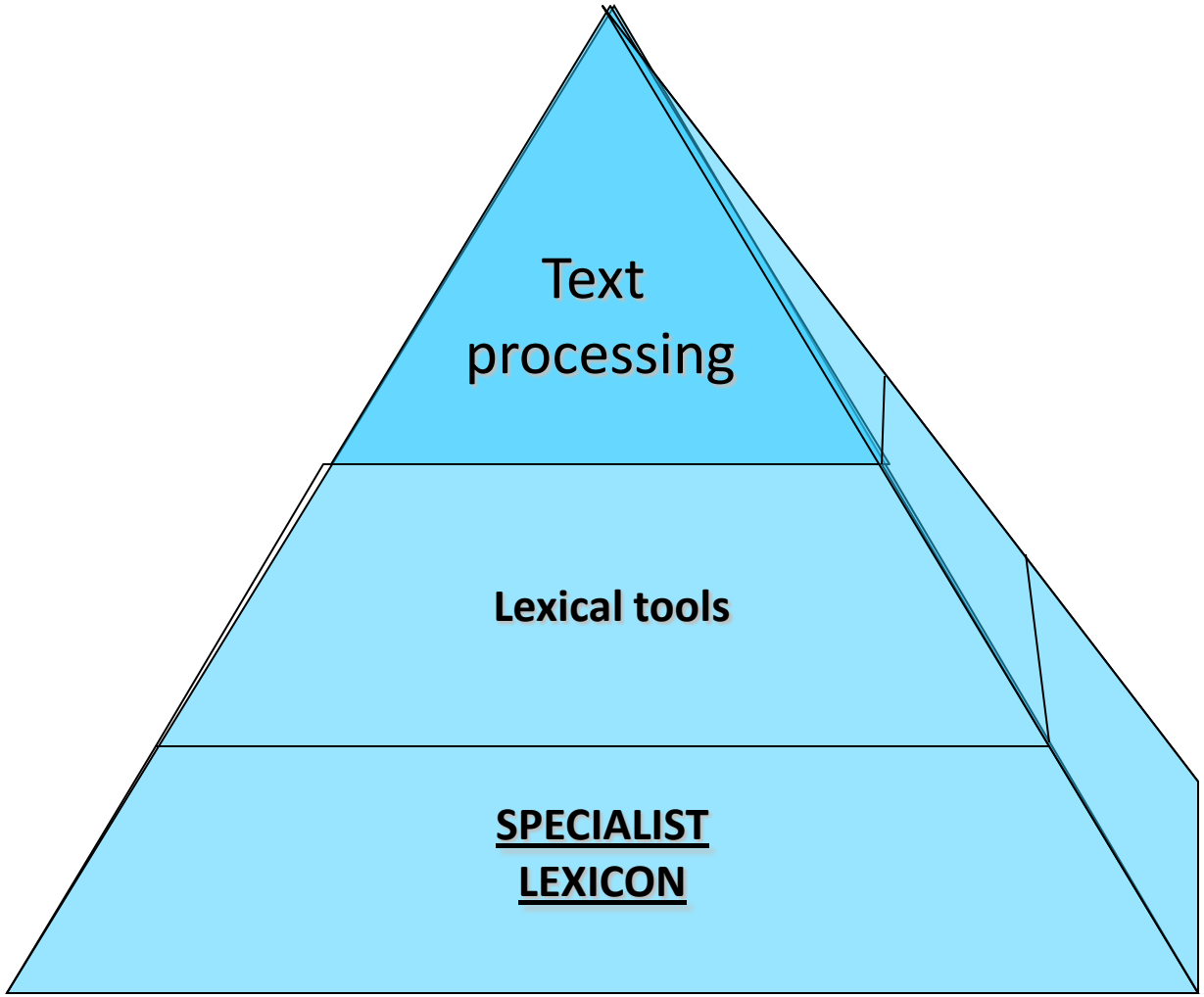
Allen Browne

Chris Lu

June 7, 2010

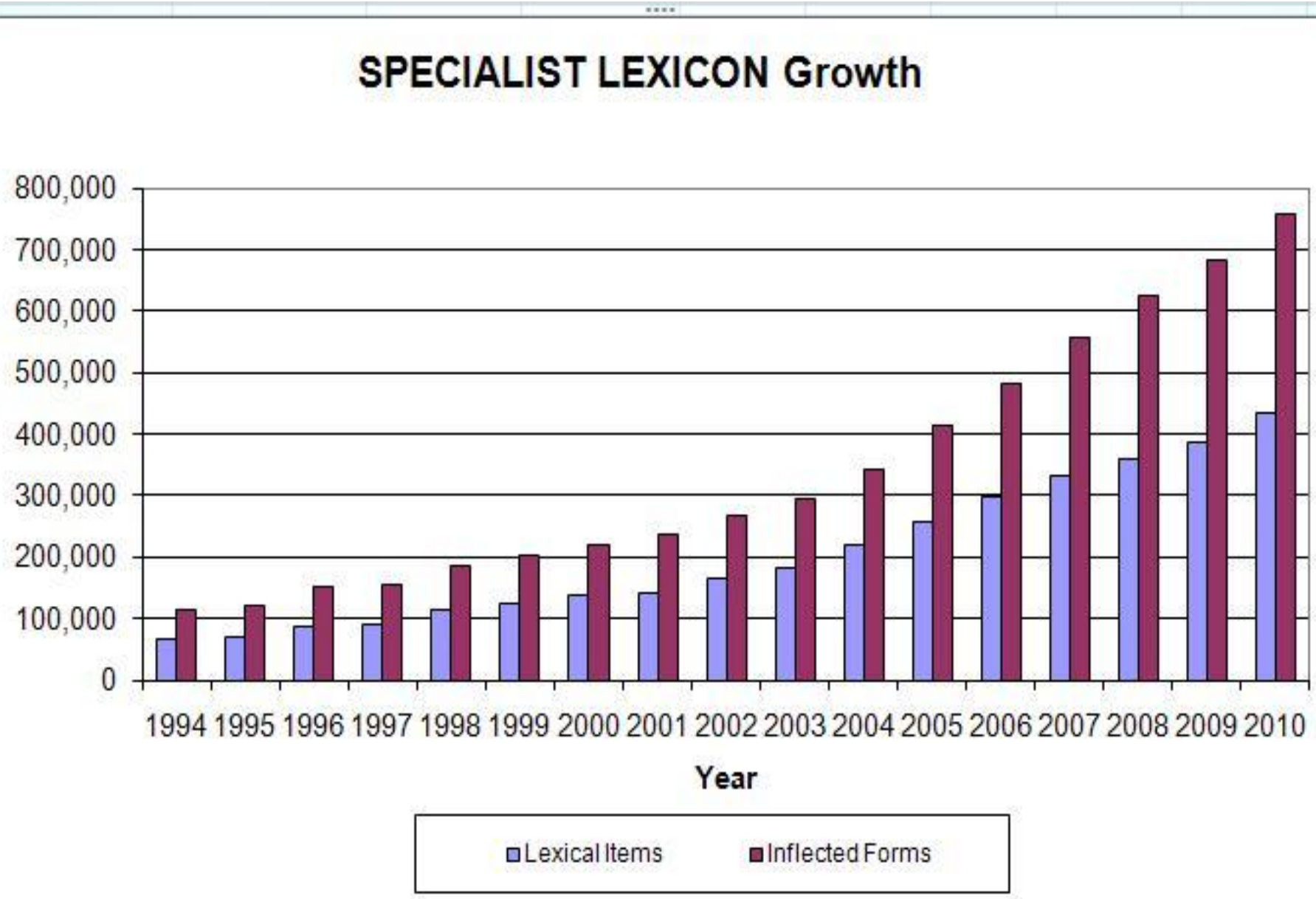
The SPECIALIST Lexicon

June 7, 2010


Text processing
Lexical tools
SPECIALIST LEXICON

The SPECIALIST Lexicon

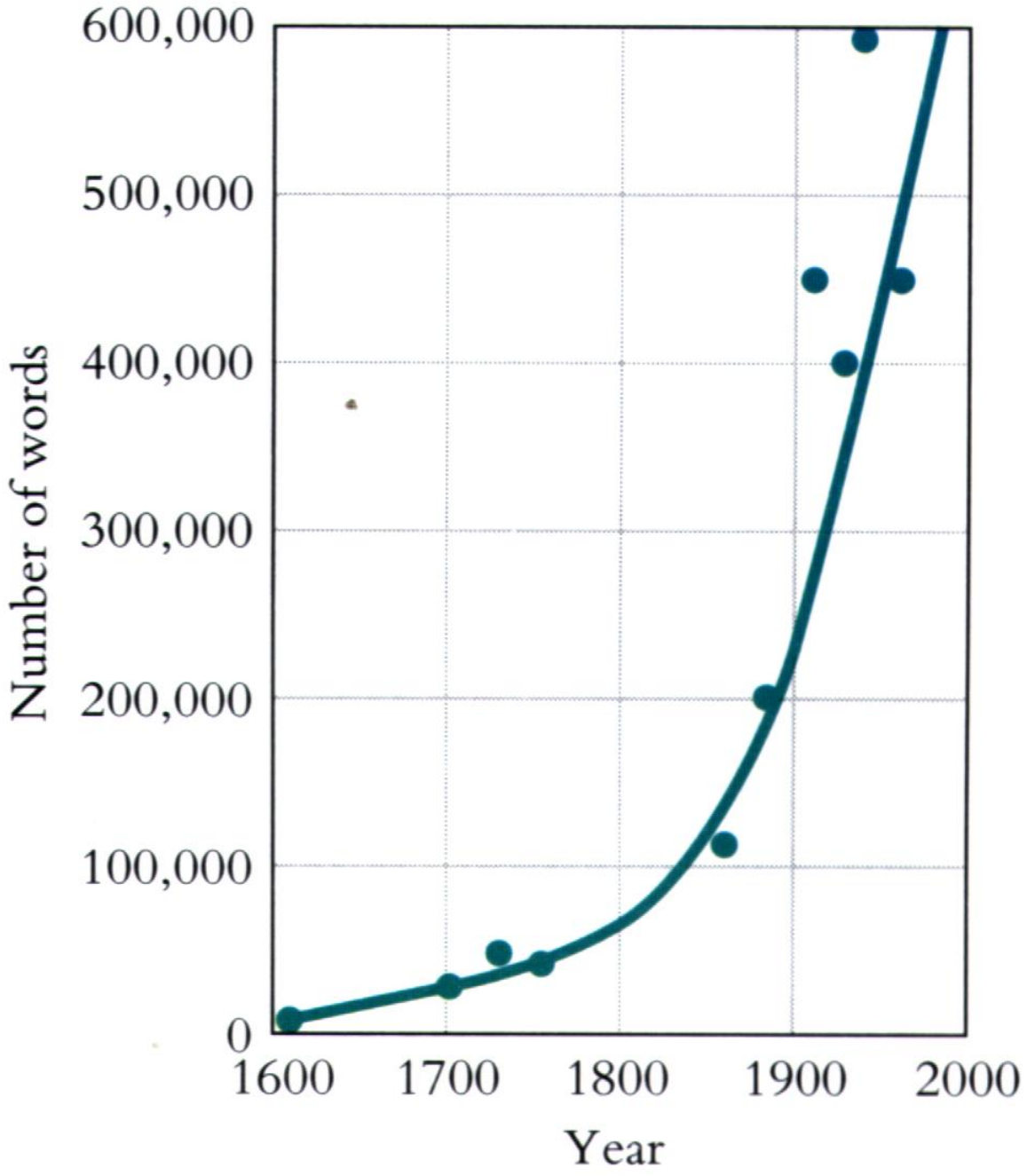
- A syntactic lexicon
- Biomedical and general English
- Over 430,000 records

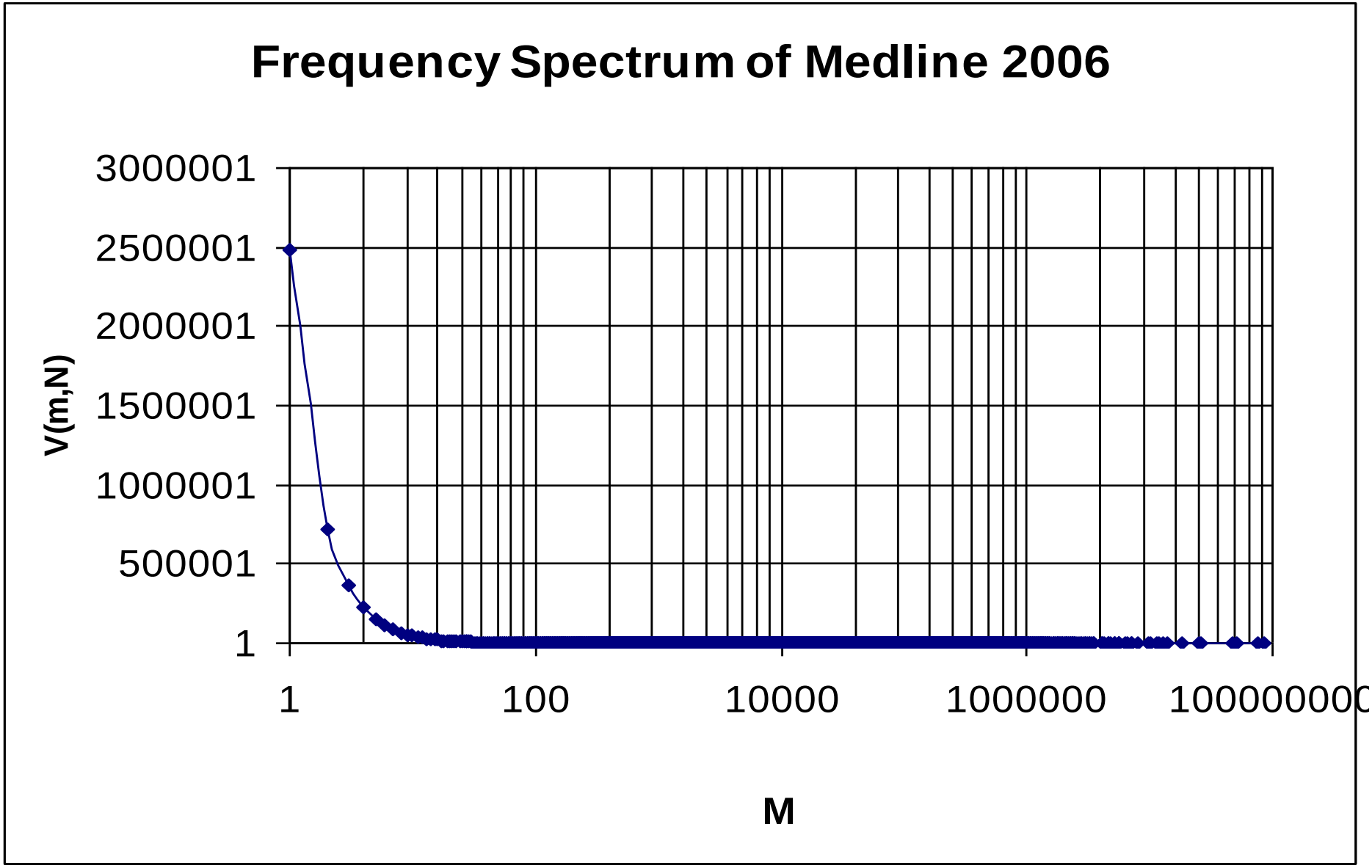

SPECIALIST LEXICON Growth
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Year
Lexical Items
Inflected Forms

George A. Miller

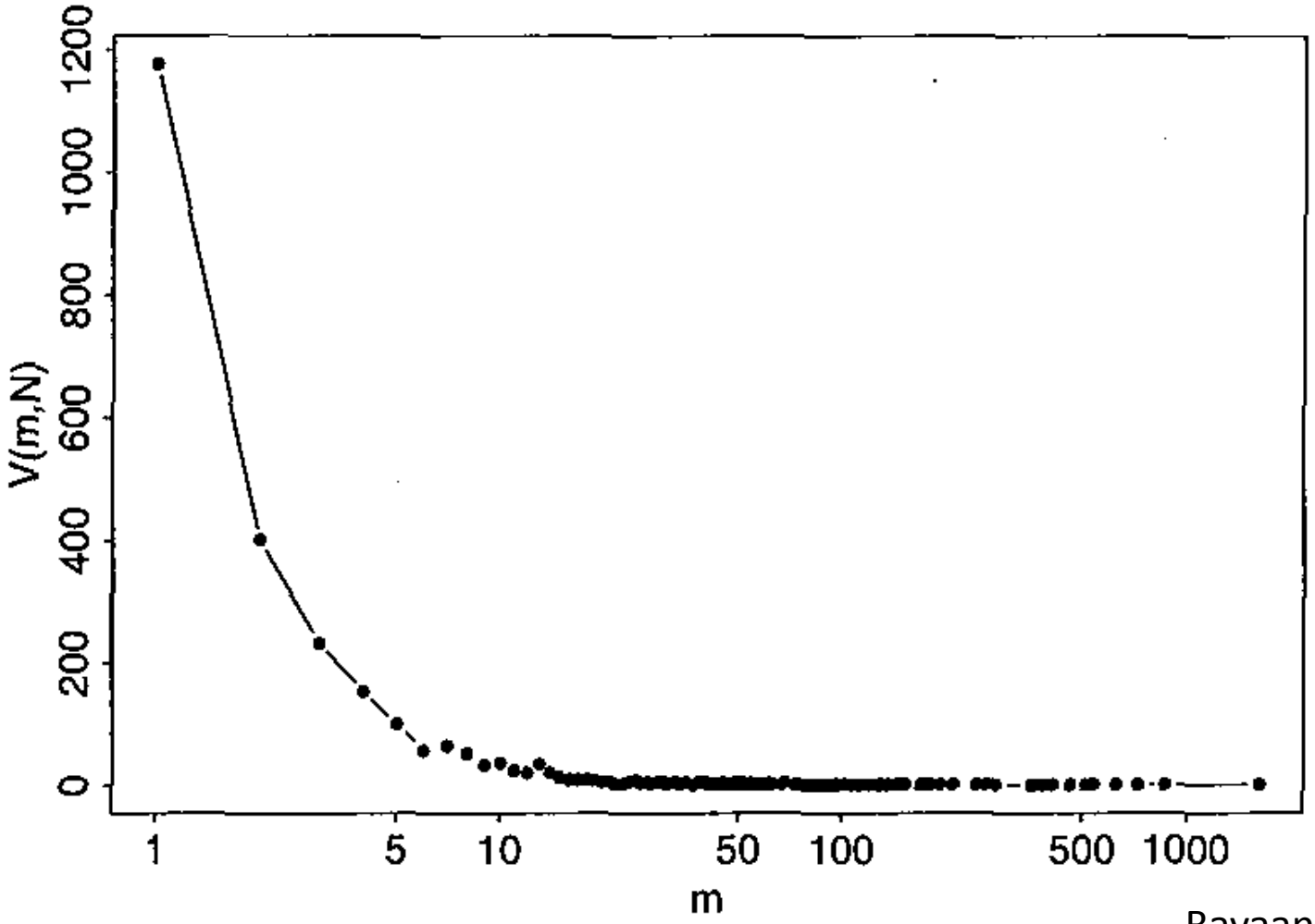
The Science of Words

1991




Frequency Spectrum of Medline 2006
3000001
2500001
2000001
1500001
1000001
500001
1
V(m,N)
1
100
10000
1000000
M

Frequency Spectrum: Alice in Wonderland



Bayaan, 2001

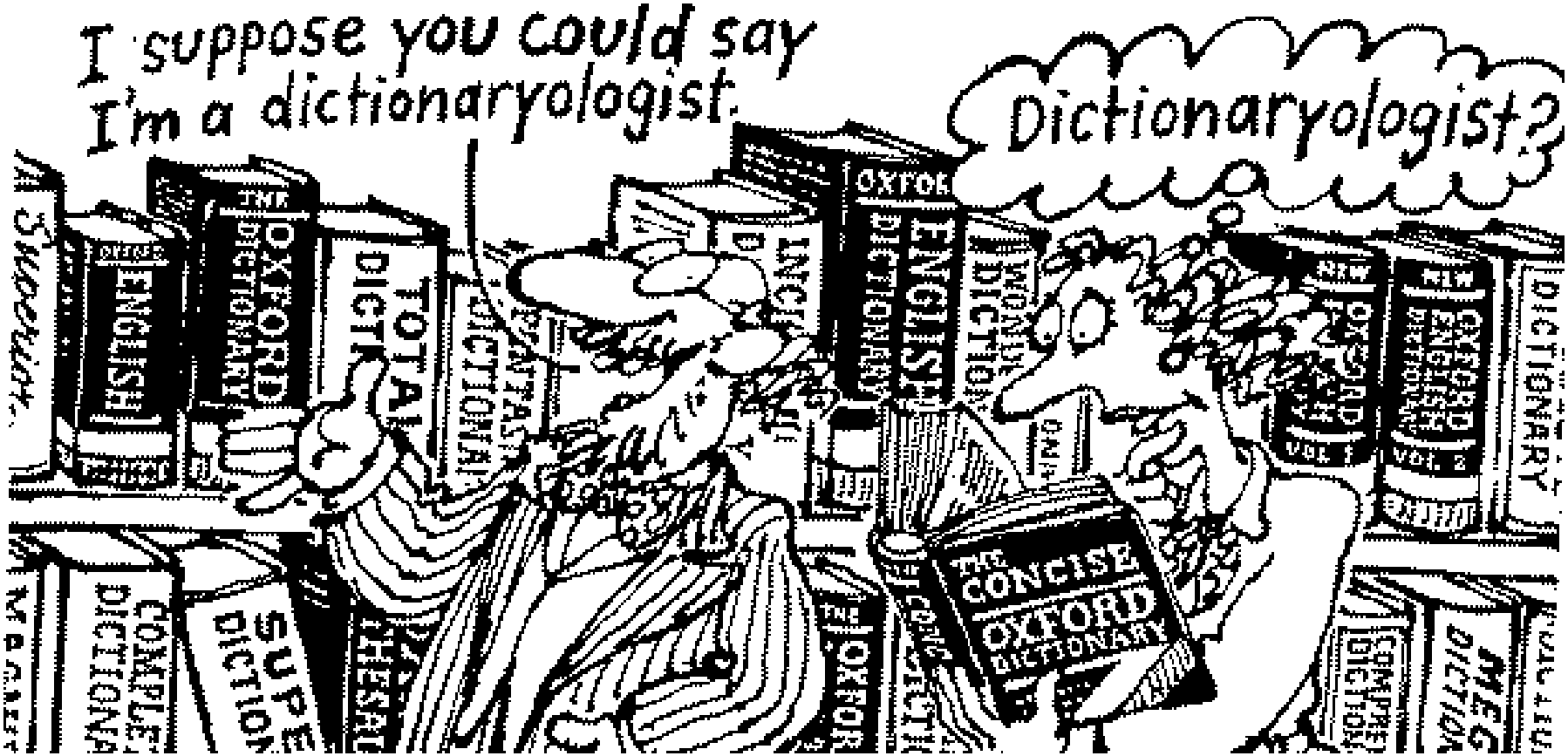
The SPECIALIST Lexicon

- Morphology
  - Inflection
  - Derivation
- Orthography
  - Spelling variants
- Syntax
  - Complementation for verbs, nouns, and adjectives

Morphology

- Inflectional
  - nucleus, nuclei
  - cauterize, cauterizes, cauterized, cauterizing
  - red, redder reddest
- Derivational
  - laryngeal -- larynx
  - transport -- transportation

Derivational Morphology



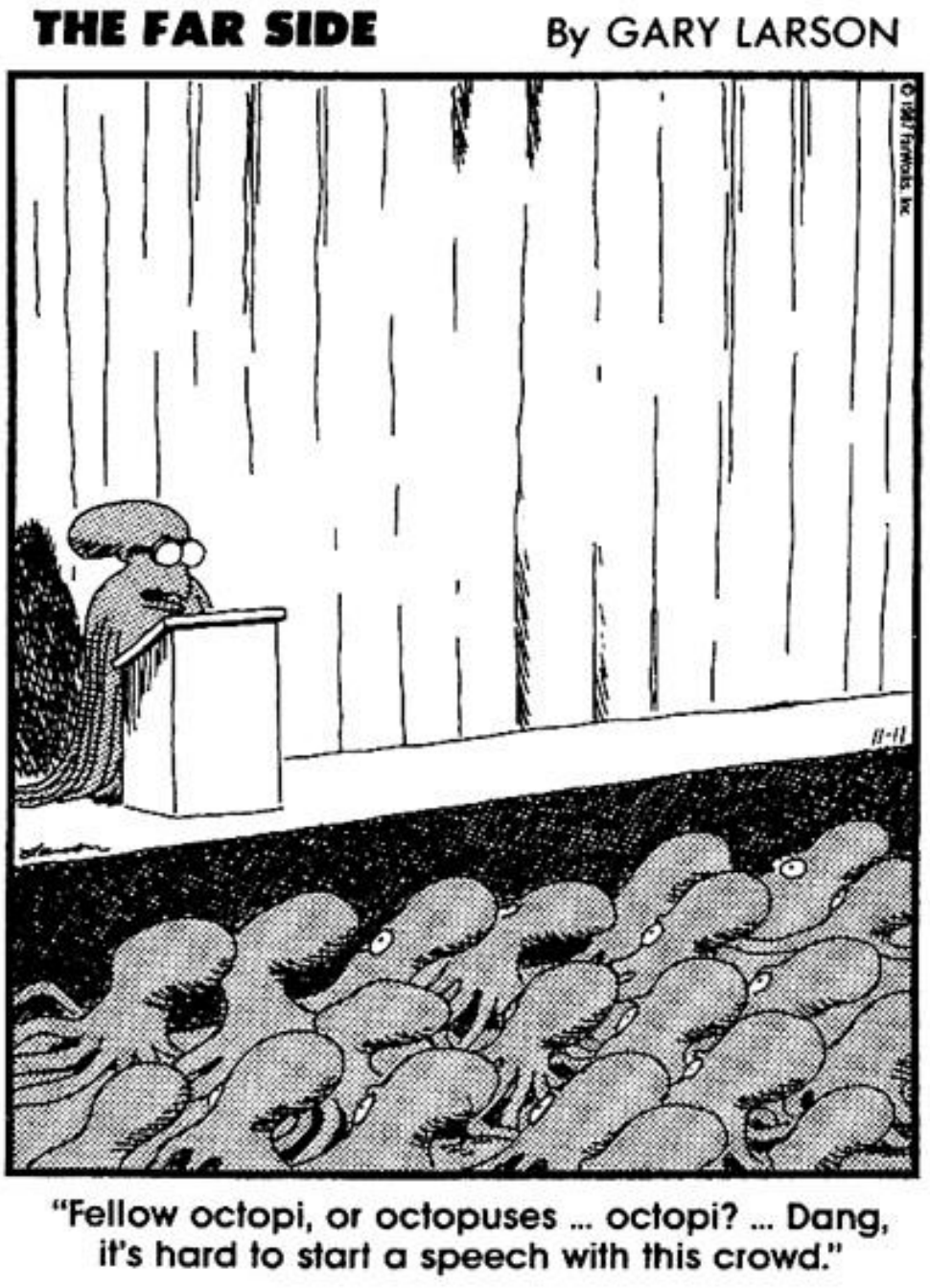
Dictionary+ology+ist

Inflectional Morphology

octopus

octopi

octopuses



Orthography

Spelling Variation

- **align -- aline**
- **Grave’s disease -- Graves’s disease -- Graves’ disease**
- **anesthetize -- anesthetise**
- **Esophagus -- oesophagus**
- **foetus – fetus**
- **centre -- center**

Orthography

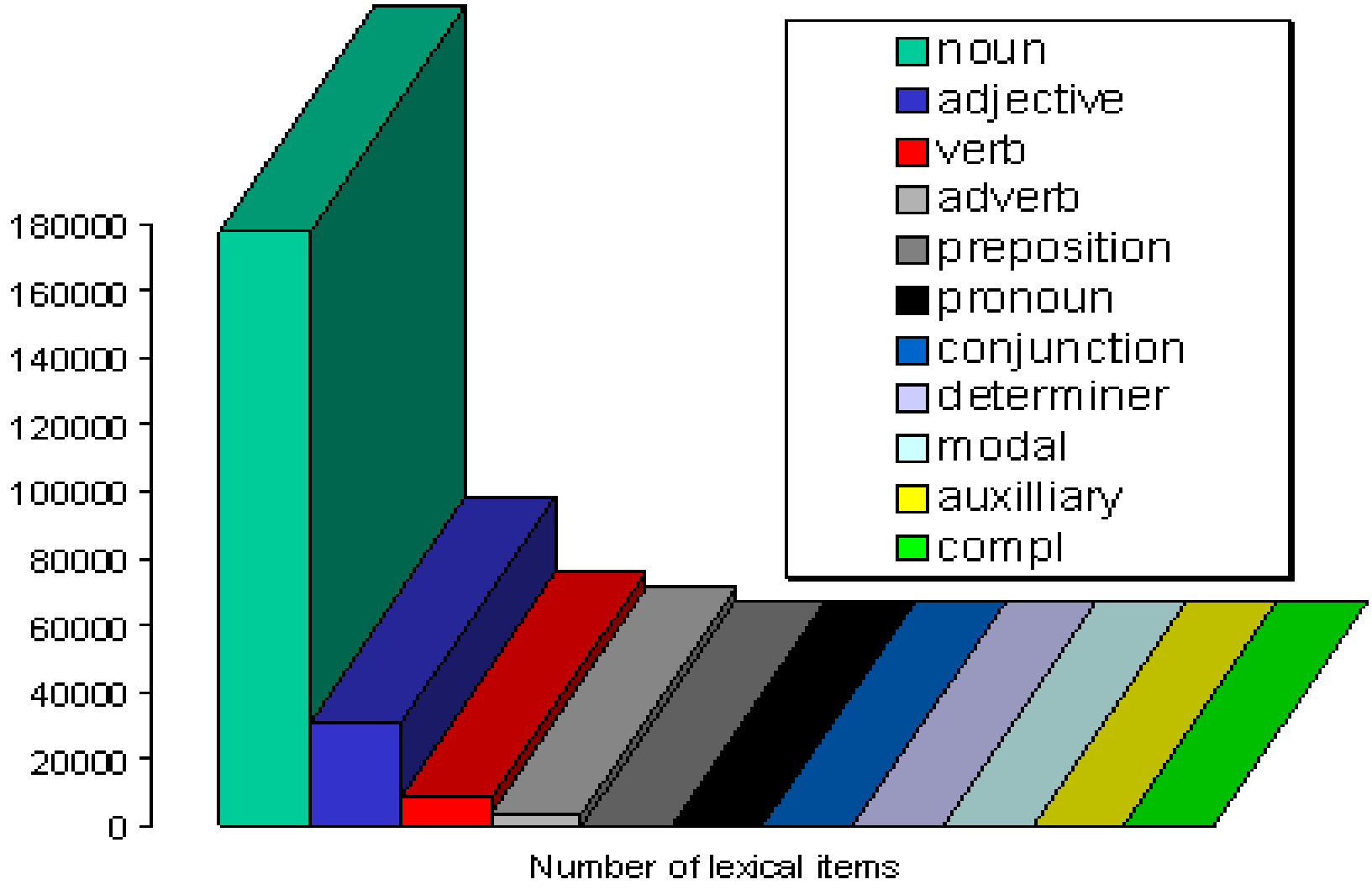
Syntax -- Verb Complements

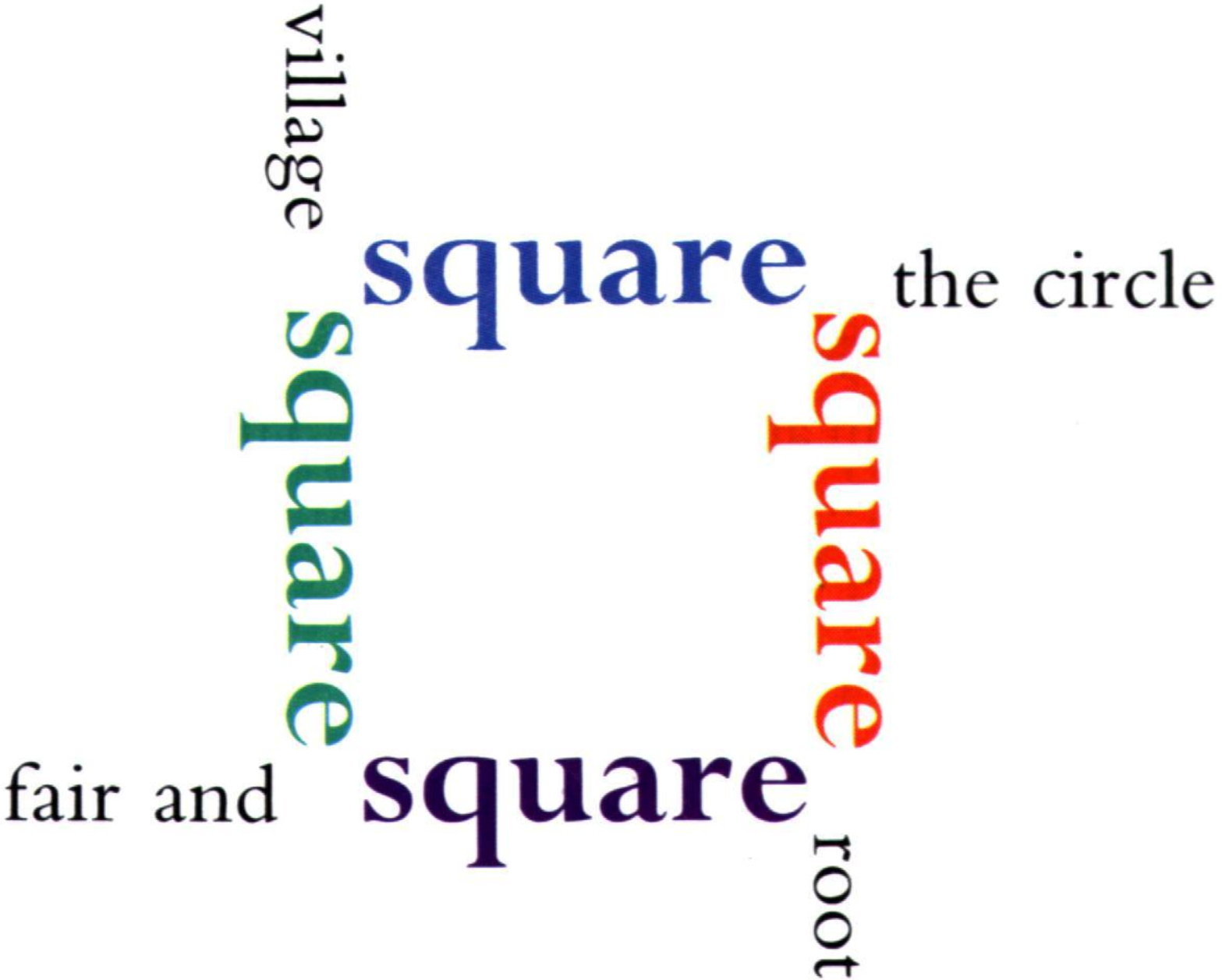
- intran
  - I'll treat.
- tran=np
  - He treated the patient.
- ditran=np,pphr(with,np)
  - She treated the patient with the drug.

Syntax -- Verb Complements

{base=treat
entry=E0061964
cat=verb
variants=reg
intran
tran=np
tran=pphr(with,np)
tran=pphr(of,np)
ditran=np,pphr(to,np)
ditran=np,pphr(with,np)
ditran=np,pphr(for,np)
cplxtran=np,advbl
nominalization=treatment|noun|E0061968
}

The SPECIALIST Lexicon




village
square
the circle
square
square
fair and
square
root

Miller -- 1991

Lexicon Unit Records

{**base=**Kaposi's sarcoma
spelling_variant=Kaposi sarcoma
entry=E0003576
cat=noun
variants=uncount
variants=reg
variants=glreg
}

{**base**=aspirate
entry=E0010803
cat=verb
variants=reg
tran=np
nominalization=aspiration|noun|E0010804
}

{**base**=chronic
entry=E0016869
cat=adj
variants=inv
position=attrib(1)
position=pred
stative
}

{**base**=in
entry=E0033870
cat=prep
}

Acronyms and Abbreviations

{base=BLM
entry=E0319730
cat=noun
variants=uncount
variants=metareg
abbreviation_of=bilayer lipid membrane|E0319734
abbreviation_of=bimolecular liquid membrane|E0319733
abbreviation_of=bleomycin|E0013378
}

Orthographic vs. Lexicographic Word:

Why, for instance, if a two-word boy scout feels chilly on his one-word campground, does he pull up a two-word camp chair in front of his one-word campfire? Anyone who seeks a strictly logical answer to such questions is chasing will-o'-the-wisps (chargeable in telegrams as a single word, because of the hyphens) in a semantic bog.

Louis Salomon, Semantics and Common Sense, Holt Rinehart and Winston, 1966.

UTF-8

{base=resume
spelling_variant=résumé
spelling_variant=resumé
entry=E0053099
cat=noun
variants=reg
}

{base=role
spelling_variant=rôle
entry=E0053757
cat=noun
variants=reg
}

{base=deja vu
spelling_variant=deja-vu
spelling_variant=déjà vu
entry=E0021340
cat=noun
variants=uncount
}

{base=cafe
spelling_variant=café
entry=E0420690
cat=noun
variants=reg
}

Noun Variants

{base=Kaposi's sarcoma
spelling_variant=Kaposi sarcoma
entry=E0003576
cat=noun
variants=uncount
variants=reg
variants=glreg
}

- Kaposi’s sarcoma
- Kaposi’s sarcomas
- Kaposi’s sarcomata
- Kaposi sarcoma
- Kaposi sarcomas
- Kaposi sarcomata

Regular Nouns

The plural suffix is *s*.
y becomes *ie* following a consonant before *s*.
e is inserted before s if the base ends in *s*, *z*, *x*, *ch*, or *s*

Leach – Leaches
Stomach – Stomachs ← irregular

Greco-latin Regular nouns

singular ends with:	plural ends with:	Examples
–us	–i	focus/foci
–ma	–mata	trauma/traumata
–a	–ae	larva/larvae
–um	–a	ilium/ilia
–on	–a	taxon/taxa
–sis	–ses	analysis/analyses
–is	–ides	cystis/cystides
–men	–mina	foramen/foramina
–ex	–ices	index/indices
–x	–ces	matrix/matrices

Uncount Nouns
(abstract or mass)

```
{base=smallpox
entry=E0056359
        cat=noun
        variants=uncount
}
{base=potassium
entry=E0049387
        cat=noun
        variants=uncount
}
```

- * a smallpox
- * two smallpoxes
- much smallpox
- * a potassium
- * two potassiums
- much potassium

* This form does not occur

Fixed Plural Nouns

{base=police
entry=E0048616
cat=noun
variants=plur
}

{base=scissors
entry=E0054633
cat=noun
variants=plur
}

Irregular Nouns

{base=corpus
entry=E0019113
cat=noun
variants=irreg|corpora|
variants=reg
}

{base=larynx
entry=E0036919
cat=noun
variants=irreg|larynges|
variants=reg
}

Regular Verbs

- The third person present tense suffix is *s.*
  - *y* becomes *ie* following a consonant before *s.*
  - *e* is inserted between z, x, ch, or sh and *s*.
- The past tense suffix is *ed*.
  - *y* becomes *ie* following a consonant before *ed.*
  - Final *e* is deleted before *ed.*

The past participle is the same as the past tense.

The present participle suffix is *ing*.

- *y* becomes *ie* following a consonant before *ing.*

- Final *e* is deleted before *ing*

unless preceded by *e, y* or *o.*

⇩

Regular Verbs

- dismiss: dismisses, dismissed, dismissing
- agree: agrees; agreed; agreeing
- dry: dries, dried, drying

Regular Doubling Verbs

- End in a CVC pattern
- Double the final consonant before *ed* and *ing*.
- Are otherwise regular
- variants=regd

control: controls, controlled, controlling

Irregular Verbs

{base=bite

entry=E0013219

cat=verb

variants=irreg|bite|bites|bit|bitten|biting|

intran

tran=np

cplxtran=np,advbl

}

Ancillary Data Bases

- Synonymy
  - sm.db
- Derivation
  - dm.db, dm.rules
- Inflection
  - im.rules
- Neoclassical compounds
  - nc.db

Derivational Facts and Rules

dm.facts

treatment|noun|treat|verb
prohibition|noun|prohibitive|adj
cell lineage|noun|cell line|noun
photochemotherapeutic|adj|photochemotherapy|noun
pharmacotherapeutic|adj|pharmacotherapy|noun

Derivational Facts and Rules

dm.rules

 # e.g. alienation|alienate
ation$|noun|ate|verb
ration|rate; station|state;

Inflectional Facts and Rules

im.rules

```
# Noun rules (glreg)
us$|noun|singular|i$|noun|plural
   antus|anti;
ma$|noun|singular|mata$|noun|plural
a$|noun|singular|ae$|noun|plural
um$|noun|singular|a$|noun|plural
on$|noun|singular|a$|noun|plural
sis$|noun|singular|ses$|noun|plural
is$|noun|singular|ides$|noun|plural
men$|noun|singular|mina$|noun|plur
al
ex$|noun|singular|ices$|noun|plural
x$|noun|singular|ces$|noun|plural
```

Neoclassical compounds

nc.db

abdomin(o)|abdomen|root
ab|away from|prefix
acanth(o)|prickle|root
acar(o)|mite|root
acetabul(o)|acetabulum|root
ad|towards|prefix
agogue|inducing|terminal
albumin(o)|albumin|root
sis|condition|terminal
stomy|surgical opening|terminal

PNEUMONOULTRAMICROSCOPICSILICOVOLCANOCONIOSIS

pneu.mo.no.ul.tra.mi.cro.scop.ic.sil.i.co.vol.ca.no.co.ni.o.sis \'n(y)u:-m*-(.)no--.*l-tr*-.mi--kr*-'ska:p-ik-'sil-i-(.)ko--(.)v\ n [NL, fr. Gk pneumo-n + ISV ultramicroscopic + NL silicon +]a:l-'ka--no--.ko--ne--'o--s*s ISV volcano + Gk konis dust : **a pneumoconiosis caused by the inhalation of very fine silicate or quartz dust**

-- Merriam Webster's 3rd International Dictionary, page 1747.

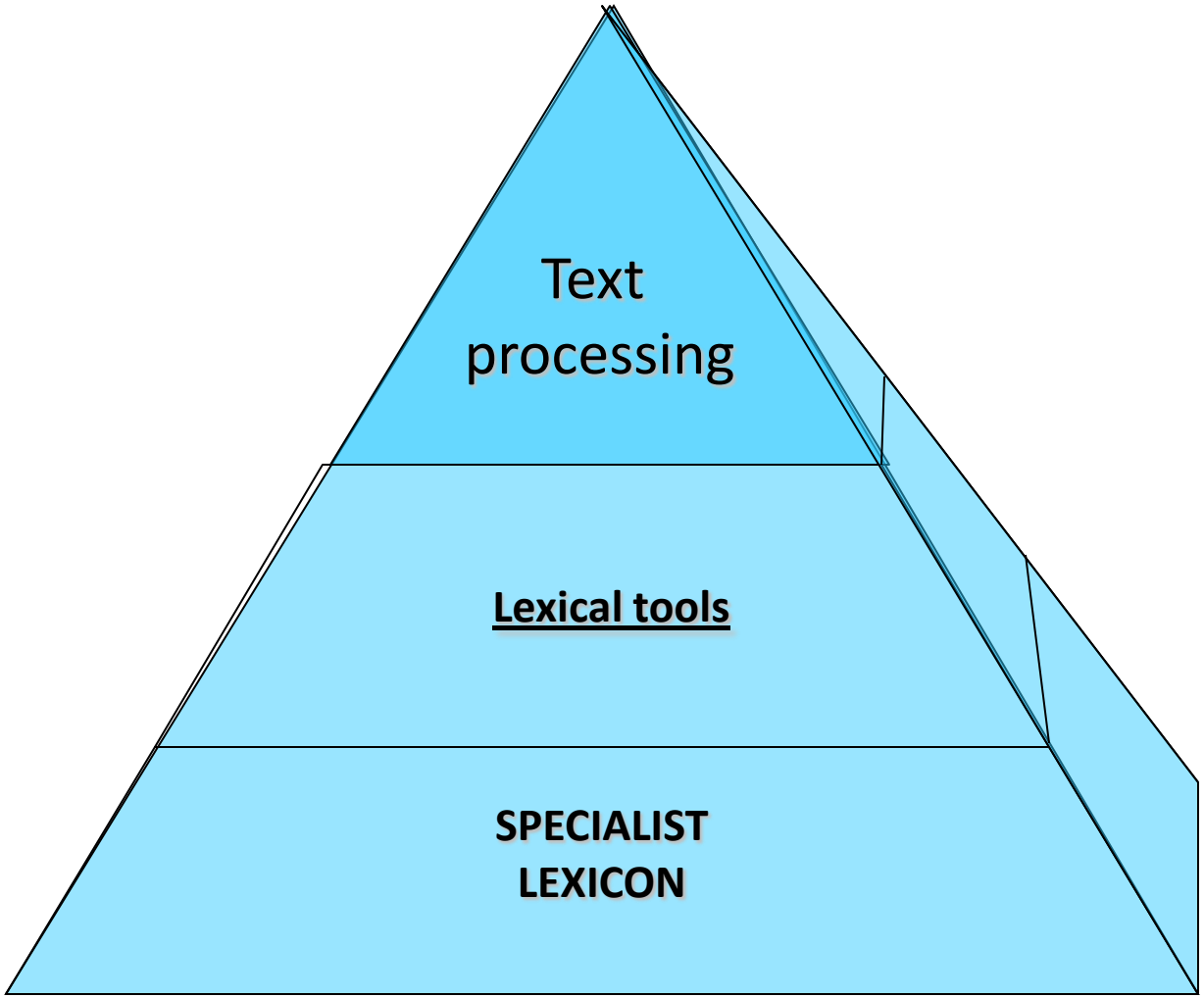
The Protein of a tobacco mosaic virus, Dahlemense strain

acetylseryltyrosylserylisoleucylthreonylserylprolylserylglutaminylph
enylalanylvalylphenylalanylleucylserylserylvalyltryptophylalanylasp
artylprolylisoleucylglutamylleucylleucyllasparaginylvalylcysteinylthr
eonylserylserylleucylglycllasparaginylglutaminylphenylalanylglutami
nylthreonylglutaminylglutaminylalanylarginylthreonylthreonylgluta
minylvalylglutaminylglutaminylphenylalanylserylglutaminylvalyltryp
tophyllysylprolylphenylalanylprolylglutaminylserylthreonylvalylargin
ylphenylalanylprolylglycylaspartylvalyltyrosyllsyslvalyltyrosylarginylt
yrosylasparaginylalanylvalylleucylaspartylprolylleucylisoleucylthreo
nylalanylleucylleucylglycylthryonylphenylalanylaspartylthreonylargi
nylasparaginylarginylisoleucylisoleucylglutamylvalylglutamylasparag
inylglutaminylglutaminylserylprolylthreonylthreonylalanylglutamylt
hreonylleucylaspartylalanylthreonylarginylarginylvalylaspartylaspart
ylalanylthreonylvalylalanylisoleucylarginylserylalanylasparaginylisol
eucylasparaginylleucylvallasparaginylglutamylleucylvalylarginylglycy
lthreonylglycylleucultyrosylasparaginylglutaminylasparaginylthreon
ylphenylalanylglutamylserylmethionylserylglycylleucylvalyltryptoph
ylthreonylserylalanylprolylalanylserine

Synonyms

sm.db

alar|adj|wing|noun
amygdaline|adj|tonsil|noun
articular|adj|joint|noun
bulbar|adj|medulla oblongata|noun
fununcular|adj|boil|noun
genicular|adj|knee|noun
hepatocellular|adj|liver cells|noun
lazar|adj|leprosy|noun
lenticular|adj|crystalline lens|noun
ypsiliform|adj|upsiloid|adj
wolfram|noun|tungsten|noun
double vision|noun|diplopia|noun


Text
processing
Lexical tools
SPECIALIST
LEXICON

Lexical Tools

- Wordind -- breaks strings into words
  - Produces the Metathesaurus word indexes (MRXW)
- LVG -- performs various lexical transformations
- NORM -- a selection of LVG transformations,
  - Used for Metathesaurus indexing
  - Produces the Metathesaurus Normalized word and string indexes (MRXNW & MRXNS)
  - Used to access those indexes

Normalization

- **Hodgkin Disease**
- **HODGKINS DISEASE**
- **Hodgkin's Disease**
- **Disease, Hodgkin's**
- **HODGKIN'S DISEASE**
- **Hodgkin's disease**
- **Hodgkins Disease**
- **Hodgkin's disease NOS**
- **Hodgkin's disease, NOS**
- **Disease, Hodgkins**
- **Diseases, Hodgkins**
- **Hodgkins Diseases**
- **Hodgkins disease**
- **hodgkin's disease**
- **Disease;Hodgkins**
- **Disease, Hodgkin**

- **disease hodgkin**

SPECIALIST NLP Tools

- Tokenizers
  - Sentence, Section, Phrases, Words
- Term variant lookup
- Part of Speech Tagger
- Index Maker

The Lexical Systems Group

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