Lexical Tools

The Lexical Tools

- Introduction
- Norm
- WordInd
- Lvg
- Installation
- Embedding This into Your Application
- Using The Lexical Tools with The Metathesaurus
- Building an Index Using The Lexical Tools
- Changes for 2003
- Additional Tools Developed by NLM

Lexical Tools: Introduction

- Command line tools
  - norm
  - lvg
  - wordInd
- Web GUI, Lexical Gui Tool (lgt)
- Embeddable Java API's

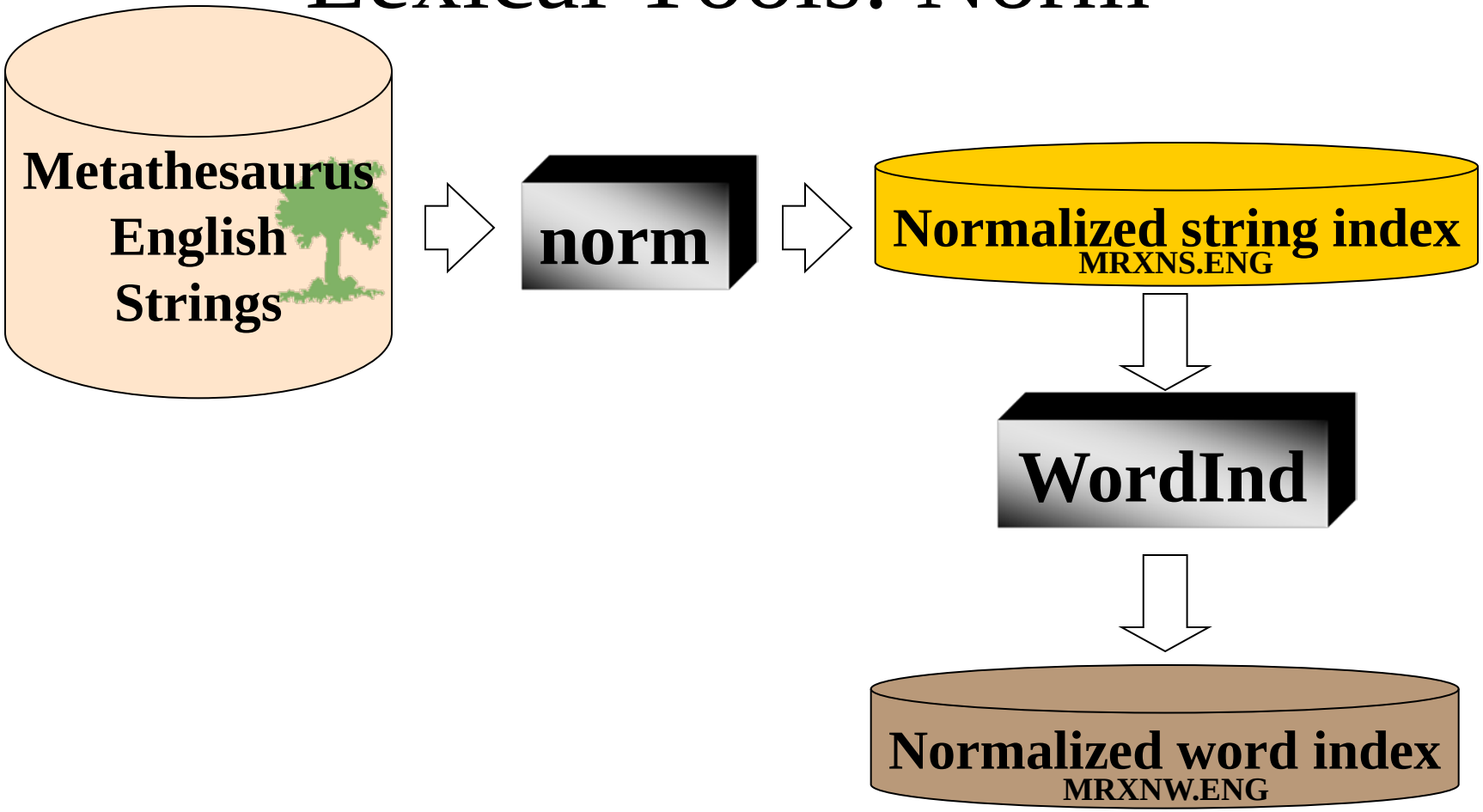
Lexical Tools: Introduction

- These tools are good for
  - aggressive text pattern matching
  - making word, term, phrase indexes
  - matching queries with indexed entries
  - increasing recall and/or precision

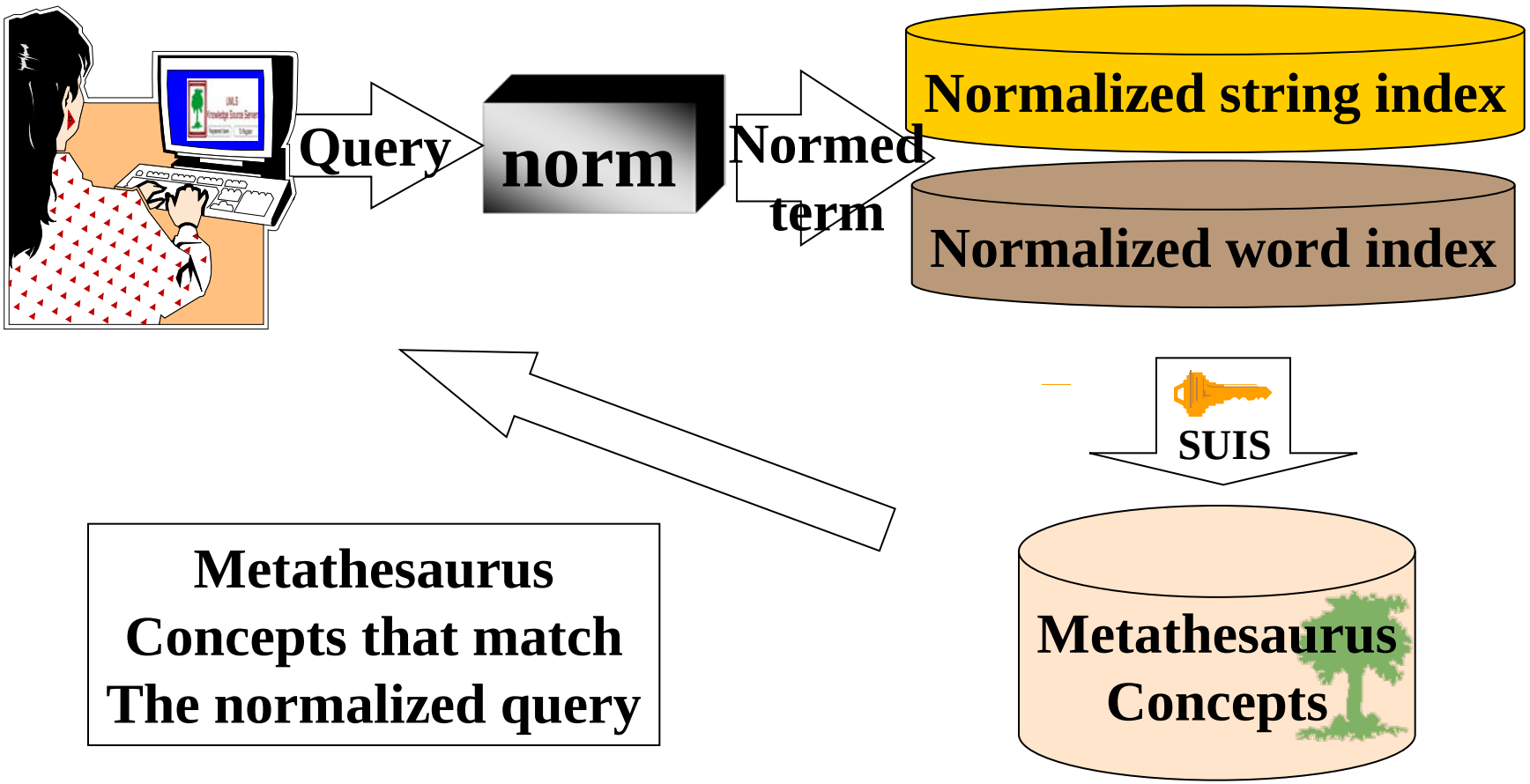
Lexical Tools: Introduction

- Characteristics of all the command line tools
  - take input from the screen or a file
  - put their results to the screen or a file
  - Interpret fielded text
    - Can be told which fields contain what type of information

Lexical Tools: Norm



Lexical Tools: Norm

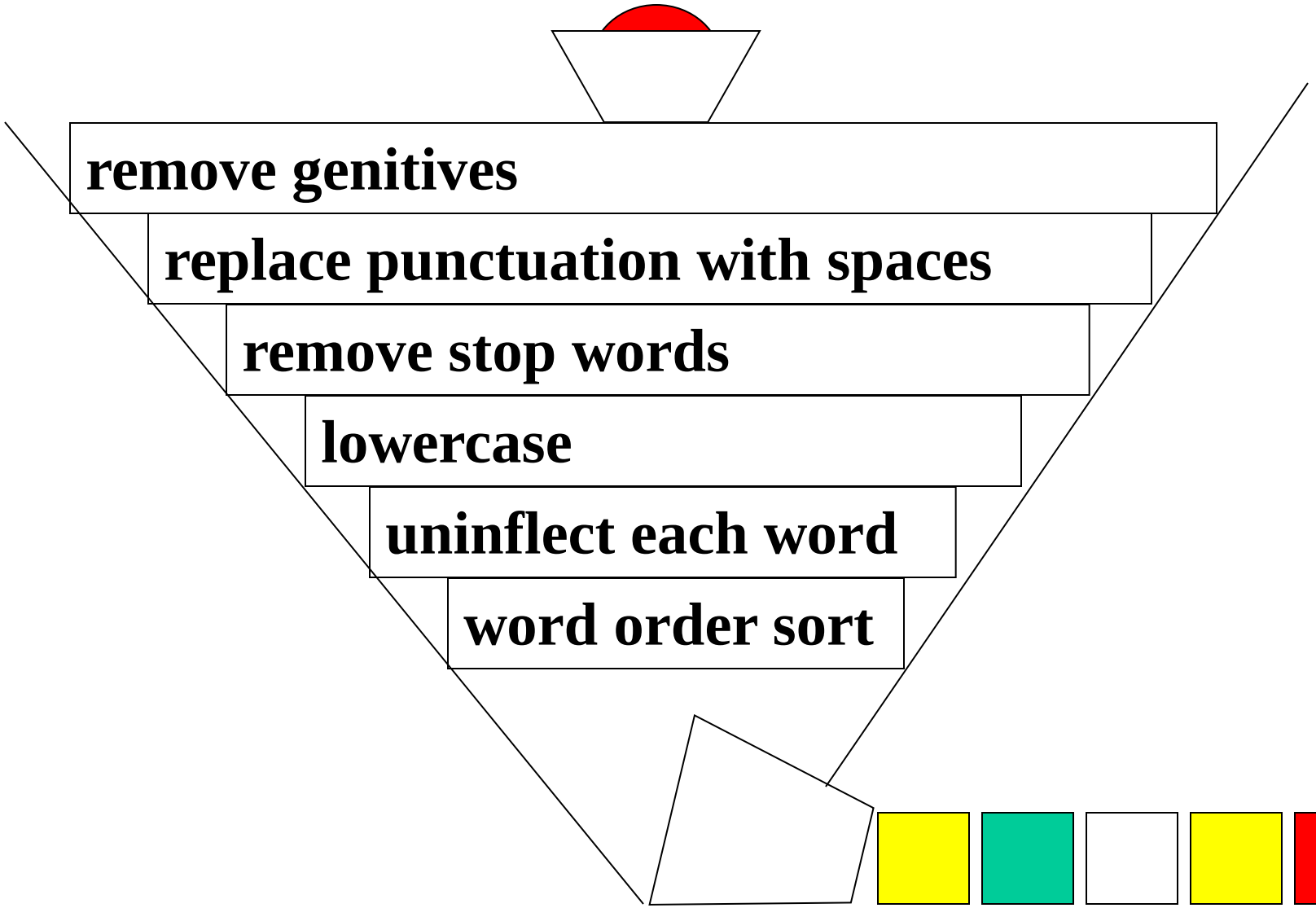


Lexical Tools: Norm

- Norm abstracts away from:
  - case
  - punctuation
  - word order
  - possessive forms
  - inflectional variation

Hodgkin's Diseases, NOS

Lexical Tools: Norm



Hodgkin's Diseases, NOS

Lexical Tools: Norm

Hodgkin'sDiseases, NOS

Hodgkin Diseases, NOS

remove genitives

replace punctuation with spaces

remove stop words

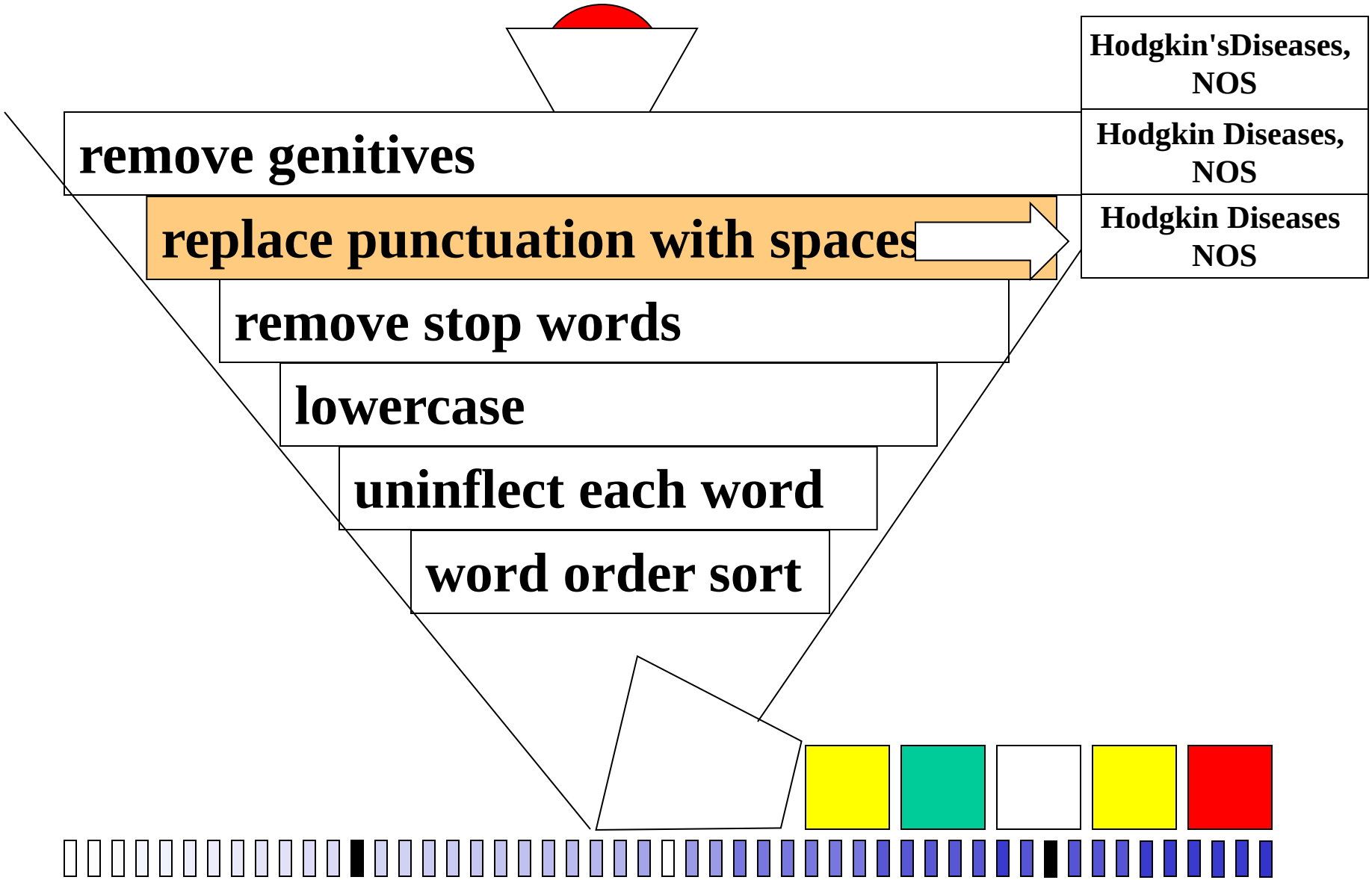
lowercase

uninflect each word

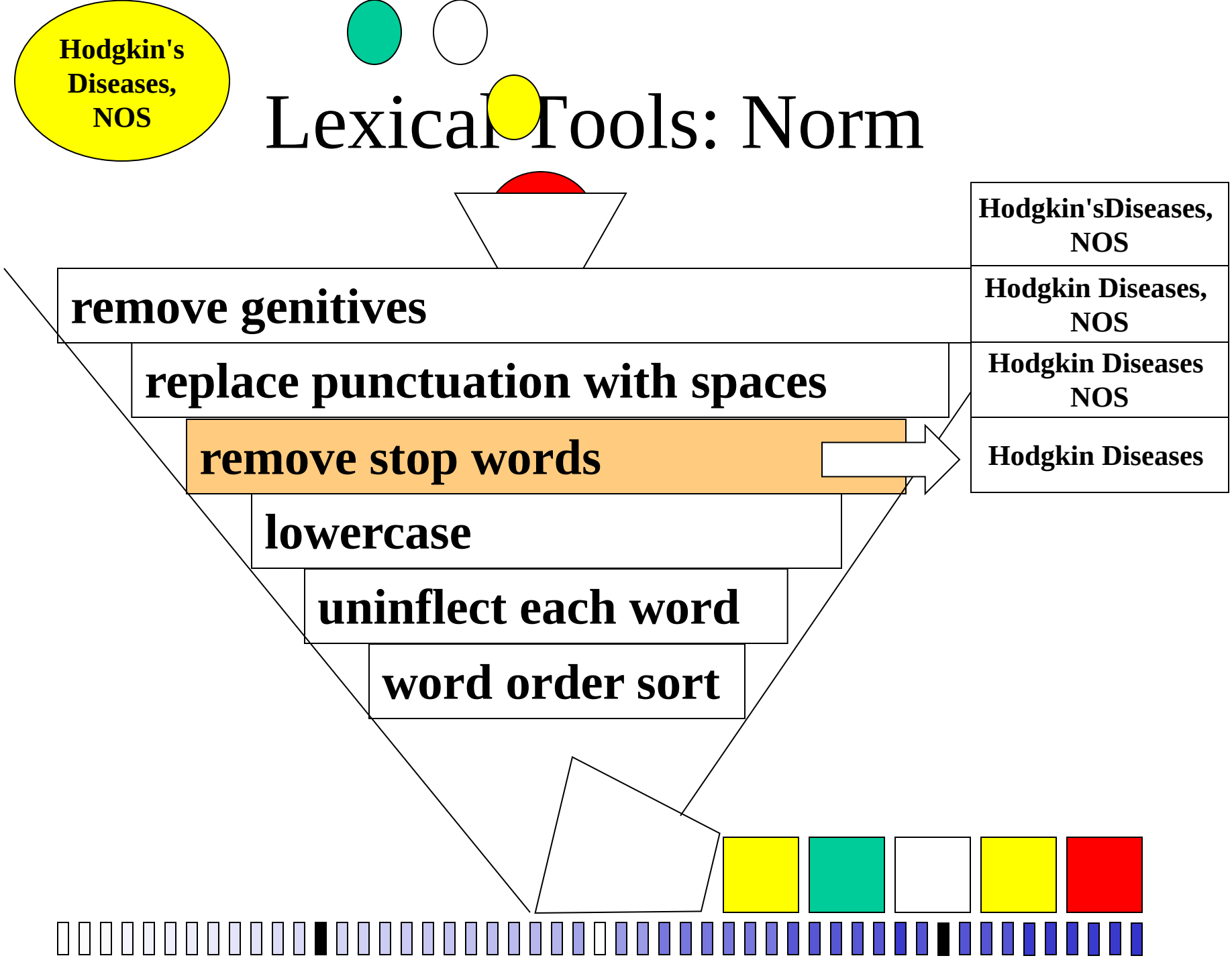
word order sort

Hodgkin's Diseases, NOS

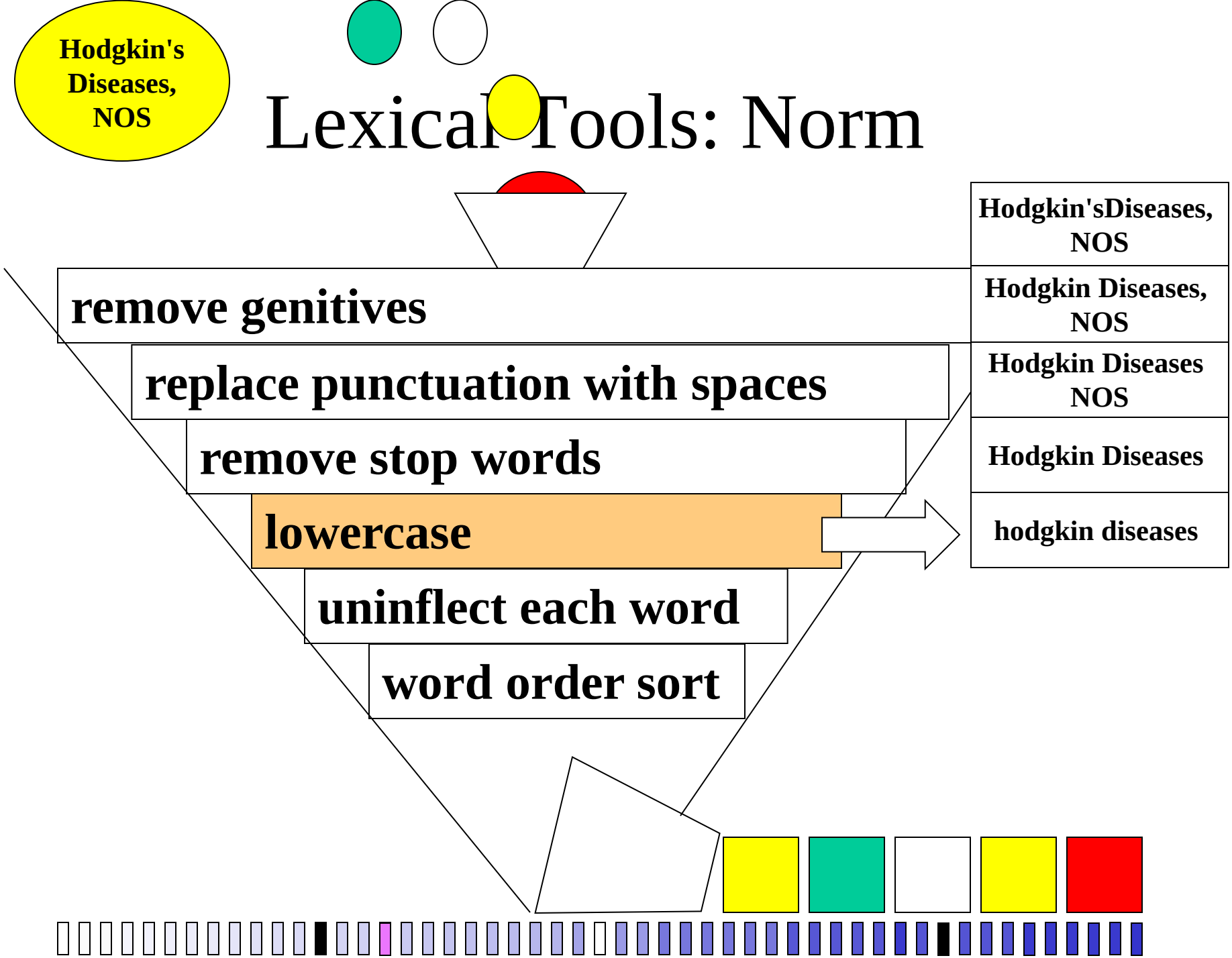
Lexical Tools: Norm



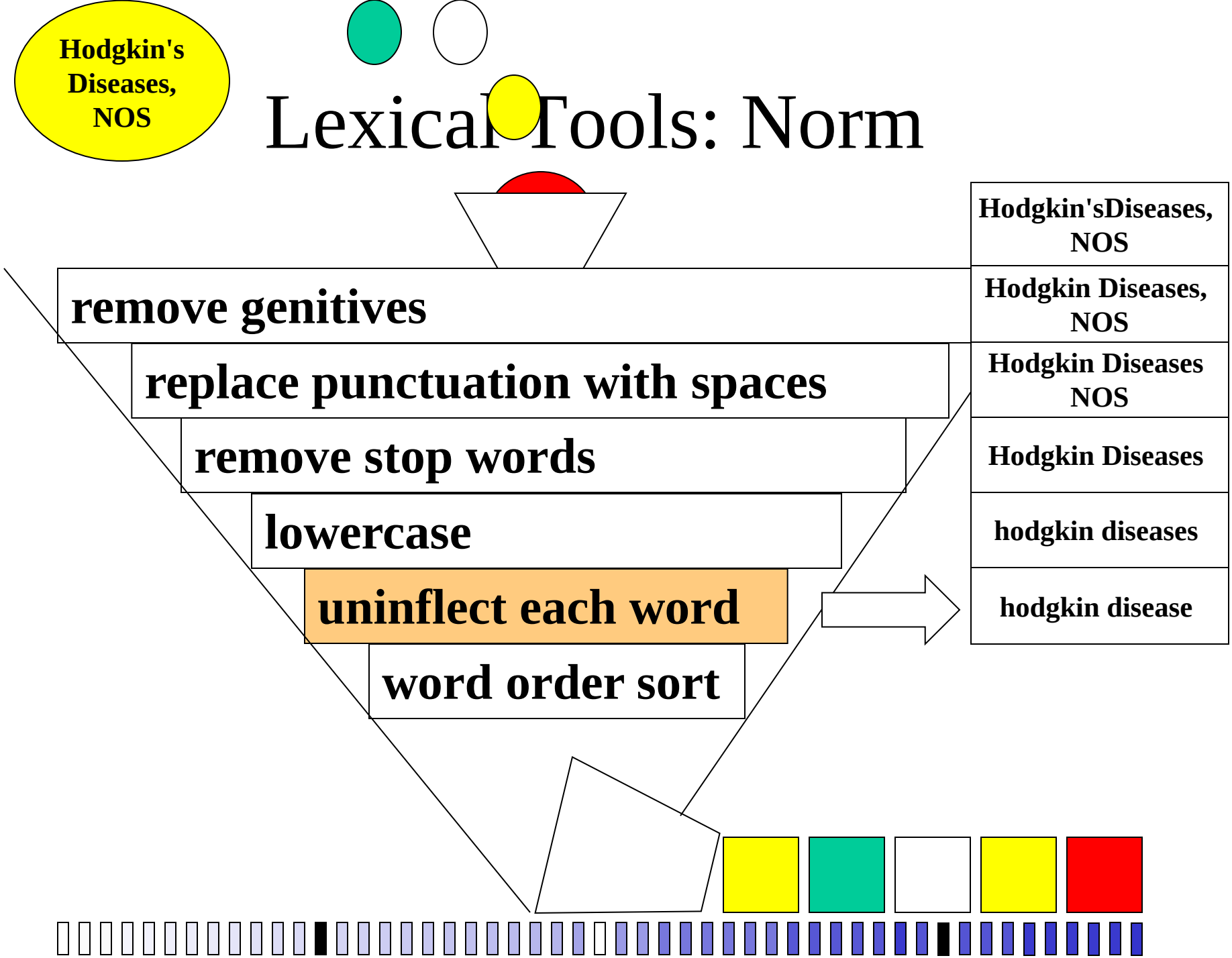
Lexical Tools: Norm



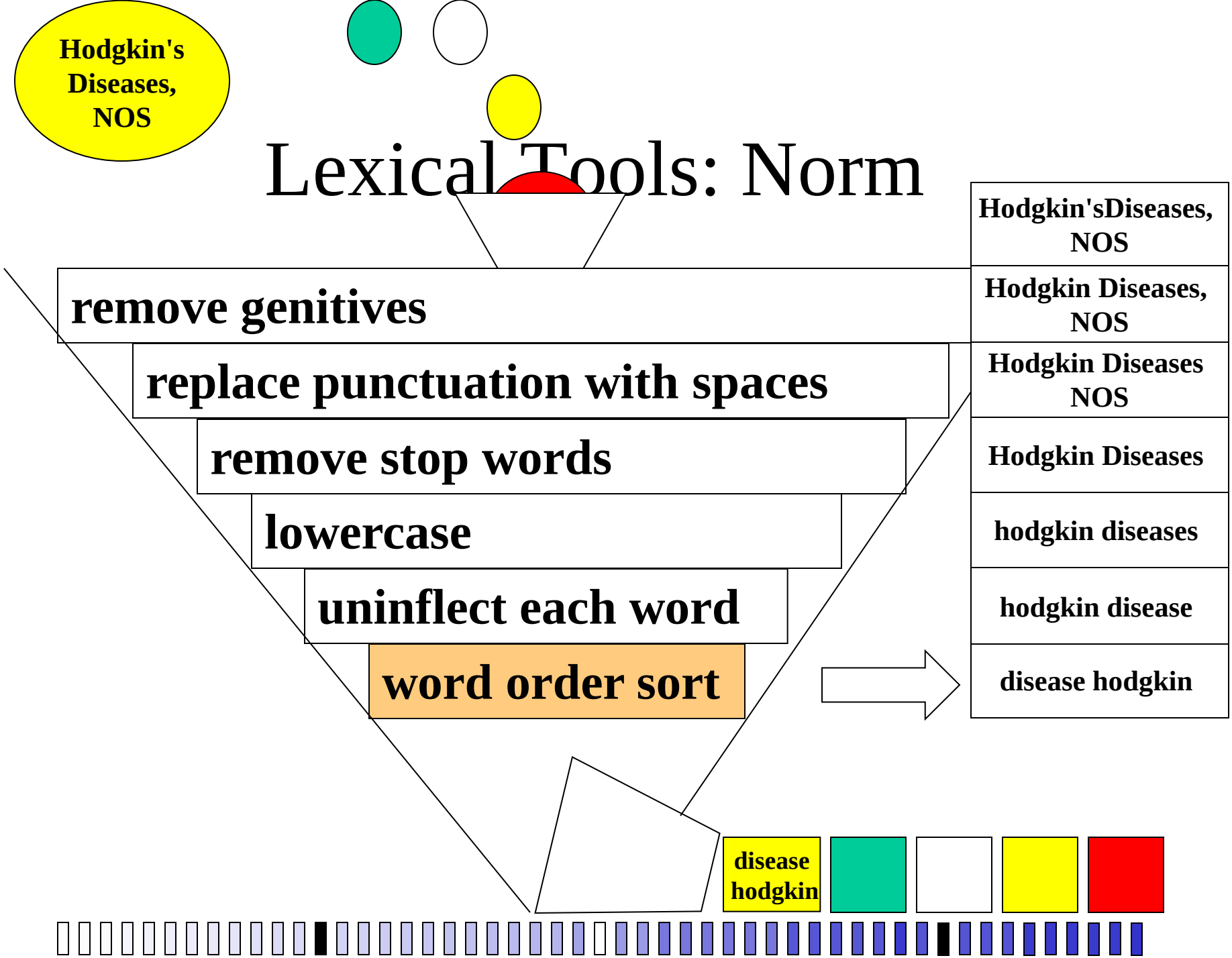
Lexical Tools: Norm



Lexical Tools: Norm



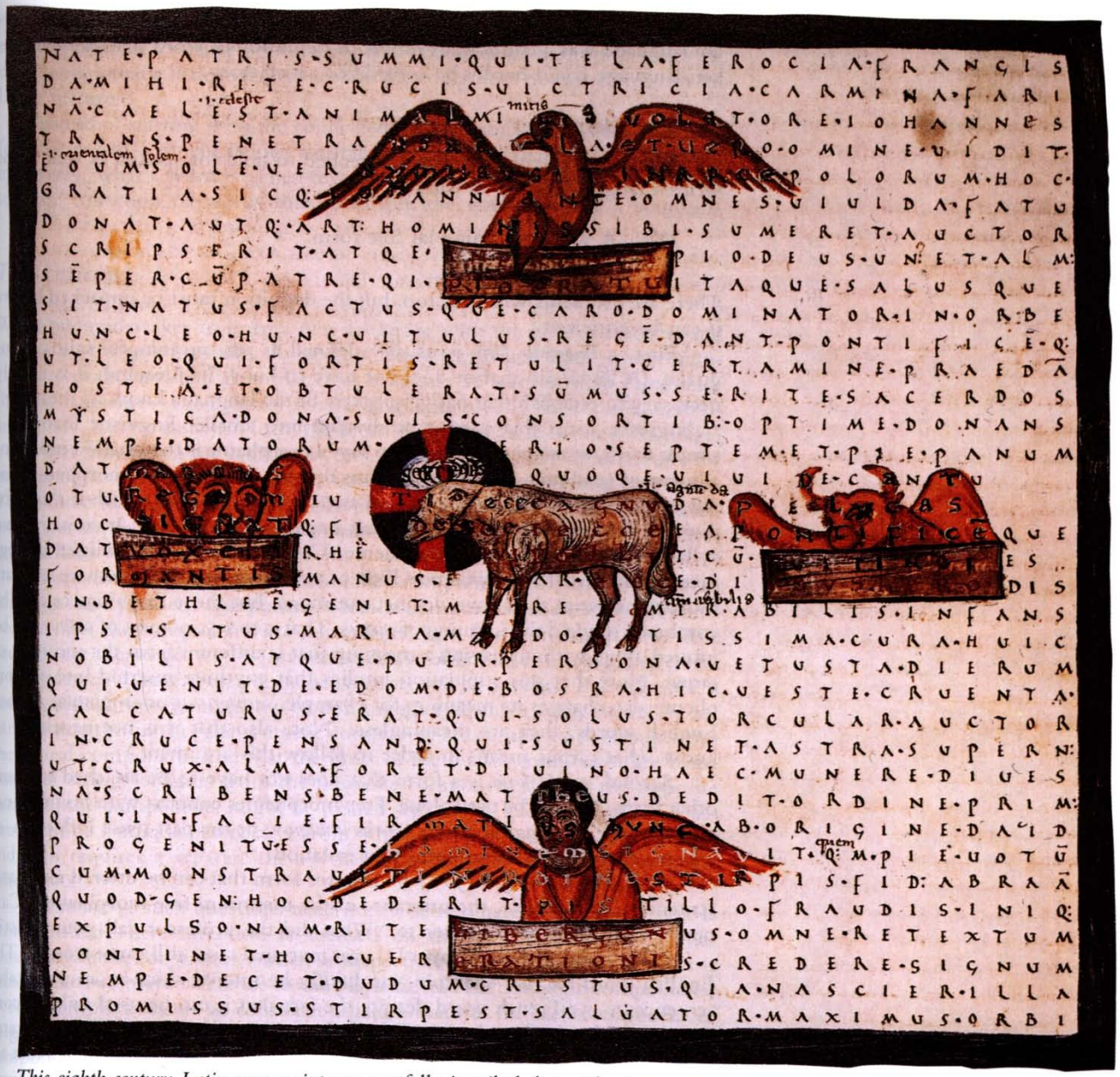
Lexical Tools: Norm



Lexical Tools: Norm

Down’s Syndrome Down Syndrome	down syndrome
Acetolyses acetolysis	acetolysis
Lung cancer Cancer, lung	cancer lung

Norm to



This eighth-century Latin manuscript was carefully inscribed, but without spaces to mark word boundaries.

Lexical Tools: WordInd

Wordind is a tool to break terms into words.

It is used to take a row from a Metathesaurus table that contains a term, sentence, paragraph, story,

and break the text part of that row into it's constituent words.

wordind
is
a
tool
to
break
terms
into
words
it
is
used
to

Lexical Tools: WordInd

- Breaks words into tokens
- Passes other fields to output, untouched
- Lowercases
- Removes white space and punctuation

Lexical Tools: WordInd

Useful command line options for wordInd

-t[:Num]	Defines what field to tokenize
-f[:Num[:Num]]	Defines what fields get passed through

Lexical Tools: WordInd

> wordInd –t:7 –F:1:6

C0185495|ENG|P|L0223844|PF|S0298948|**Denis-Browne splint strapping**|3|

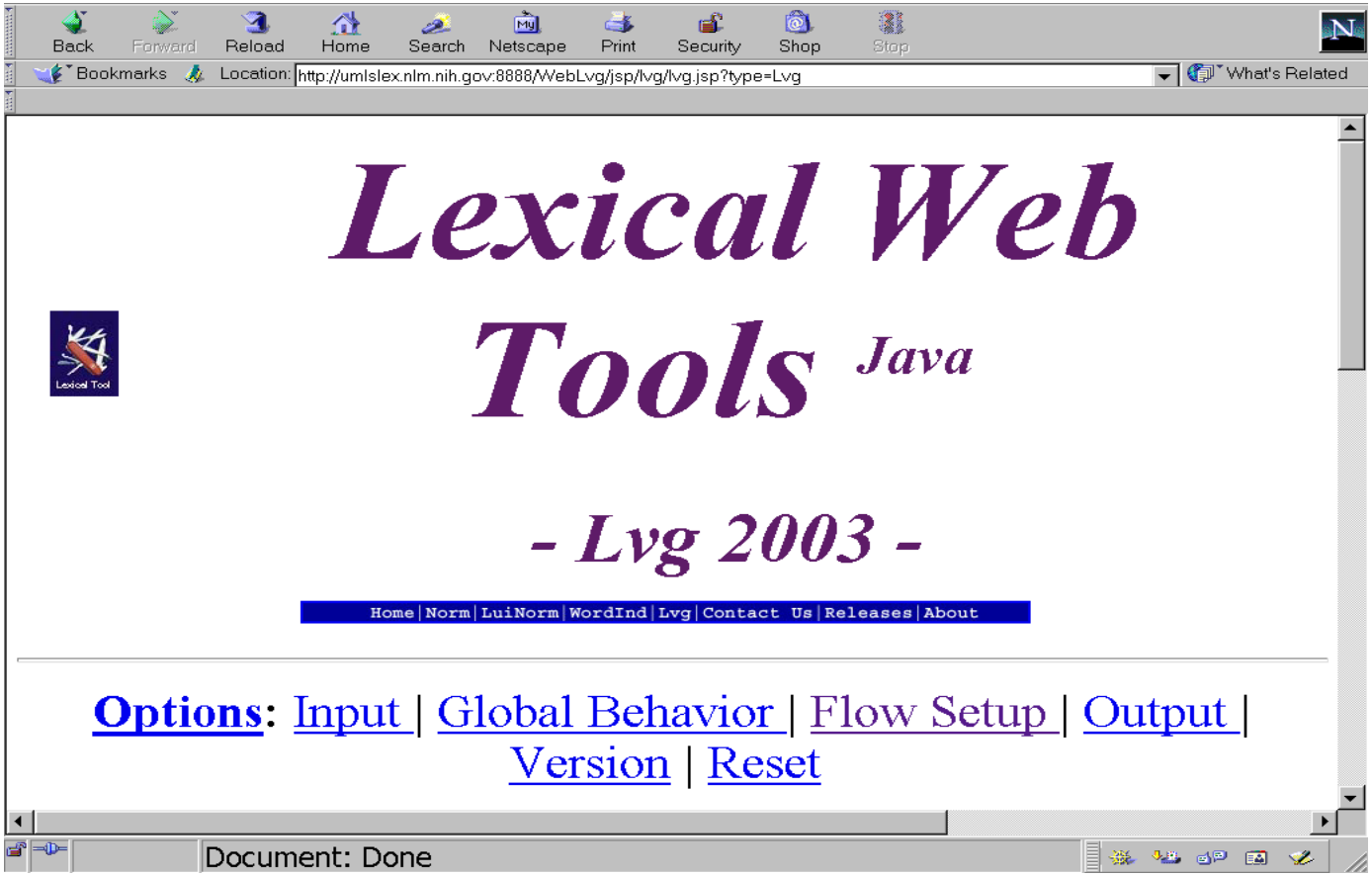
C0185495|S0298948|**denis**

C0185495|S0298948|**browne**

C0185495|S0298948|**splint**

C0185495|S0298948|**strapping**

Lexical Tools: Lvg



Lexical Tools: Flow Components

Mnemonic	Tool
A	Return known acronyms
a	Return known acronym expansions
B	Uninflect words in a term
b	Uninflect a term
C	Canonicalize
c	Tokenize a term into "words"
ca	Tokenize, keep everything
ch	Tokenize without breaking hyphens

Lexical Tools: Flow Components

Mnemonic	Tool
Ct	Retrieve the citation term
d	Generate derivational variants
dc~N	Generate derivational variants with specifying output categories
R	Generate derivational variants, recursively
E	Retrieve the unique EUI for a term
f	Filter output to contain only forms from lexicon

Lexical Tools: Flow Components

Mnemonic	Tool
Gn	**Generate known fruitful variants**
g	**Remove genitive**
i	**Generate inflectional variants**
ici~Cats+Infls	**Generate inflectional variants, by Categories and inflections**
is	**Generate inflectional variants, by Categories and inflections**
Si	**Inflections to simplified inflections**

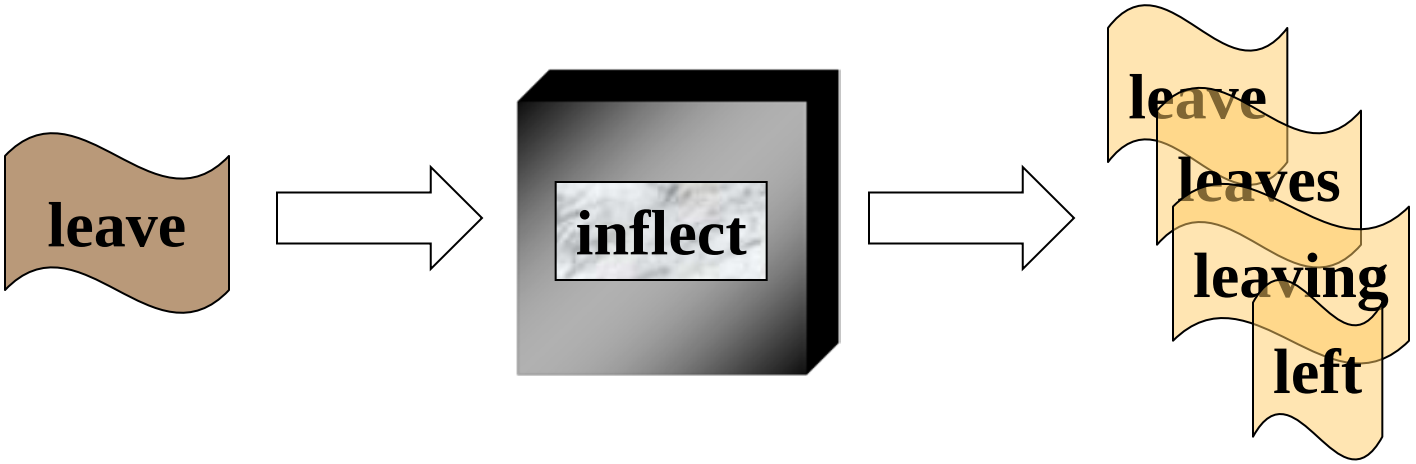
Lexical Tools: Flow Components

Mnemonic	Tool
L	Retrieve category and inflection for a term
l	Lowercase
N	Normalize the input text in a non-canonical way (Norm)
o	Replace punctuations with spaces
p	Strip Punctuation
q	Strip diacritics

Lexical Tools: Flow Components

Mnemonic	Tool
s	**Generate known spelling variants**
t	**Strip stop words**
u	**Uninvert the input phrase around commas**
w	**Sort words by order**
y	**Generate synonyms**
r	**Generate synonyms, recursively**

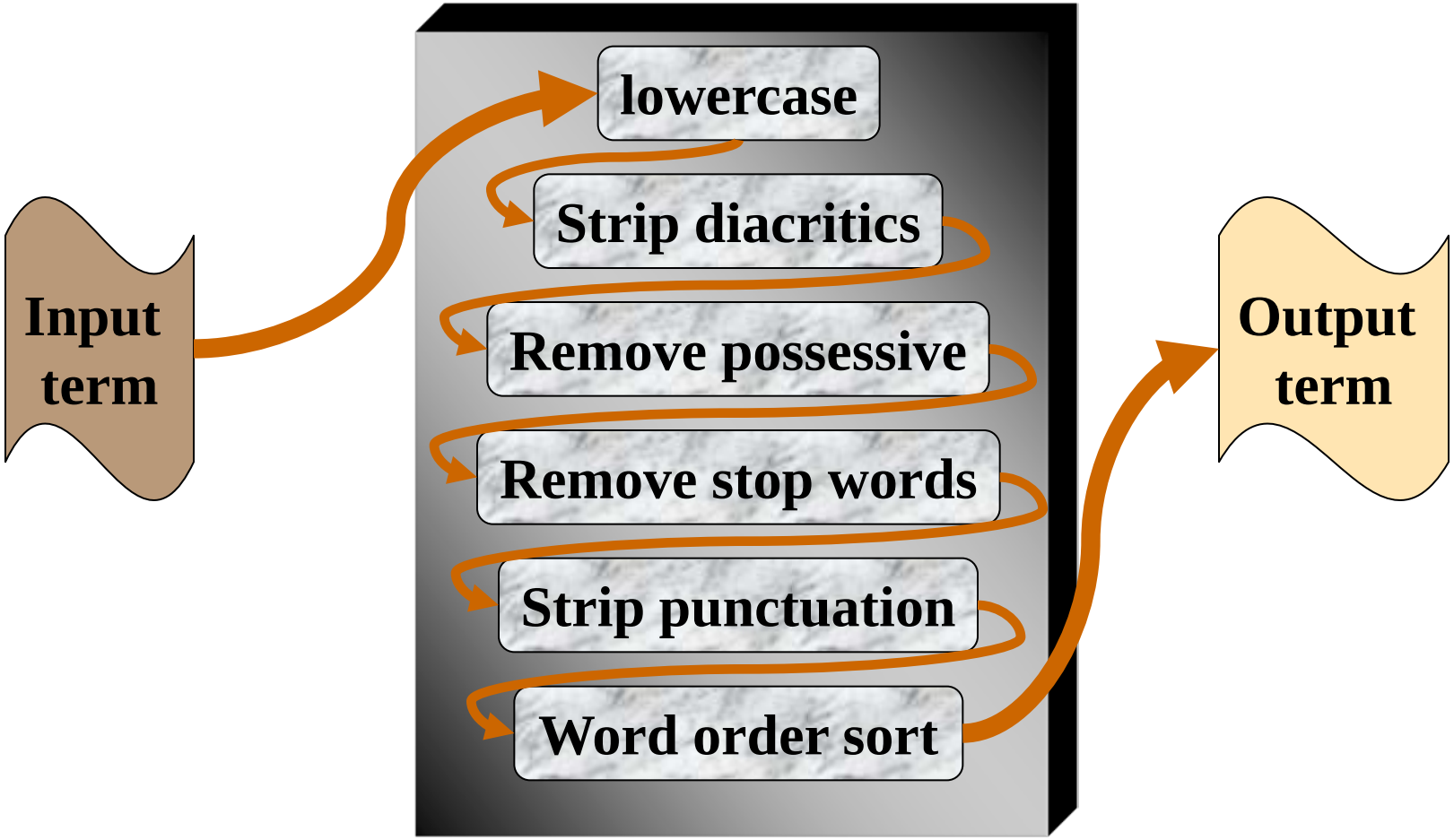
Lexical Tools: Flows



Lexical Tools: Flows

```
> lvg –f:i
leave
leave|leave|128|1|i|1|
leave|leave|128|512|i|1|
leave|leaves|128|8|i|1|
leave|left|1024|64|i|1|
leave|left|1024|32|i|1|
leave|leave|1024|1|i|1|
leave|leave|1024|262144|i|1|
leave|leave|1024|1024|i|1|
leave|leaves|1024|128|i|1|
leave|leaving|1024|16|i|1|
```

Lexical Tools: A Serial Flow



Flow components can be arranged so that the output of one is the input to another.

Lexical Tools: A Serial Flow

> lvg –f:l:q:g:t:p:w

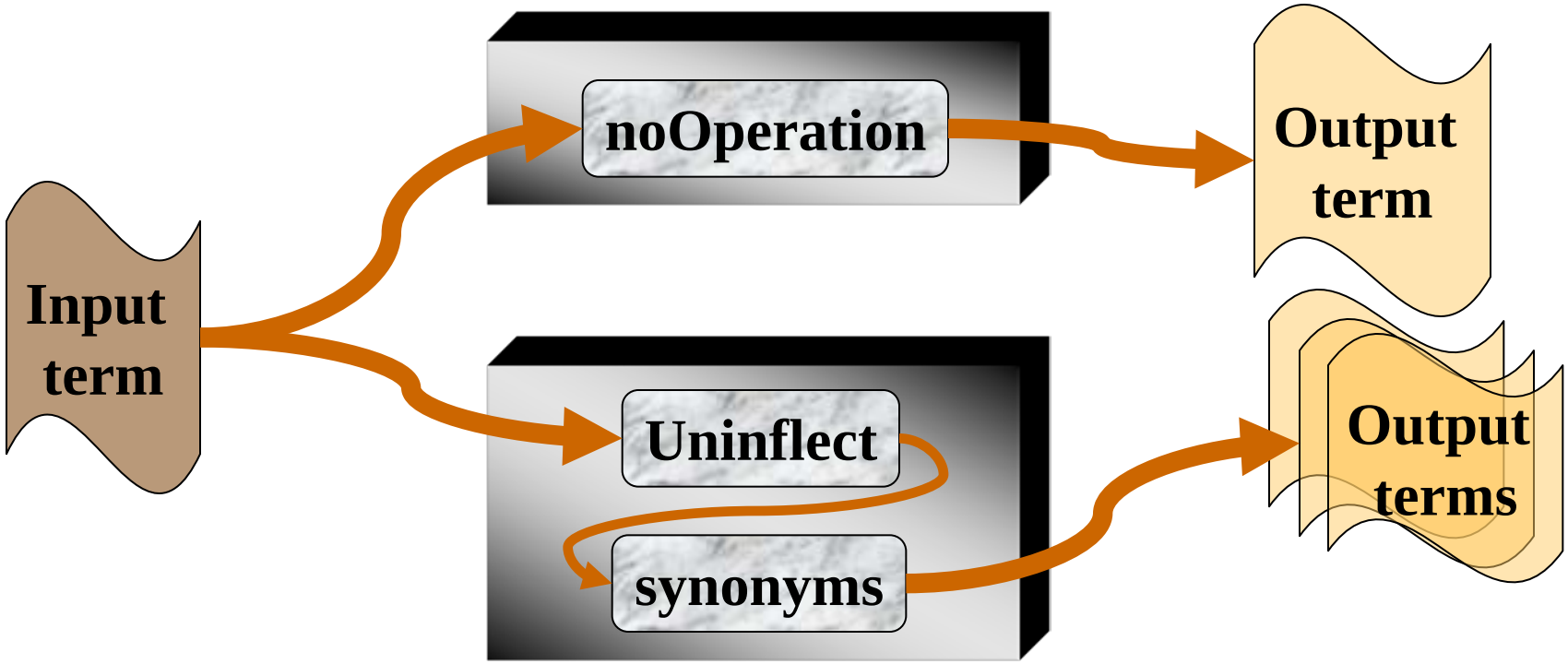
The Gougerot-Sjögren's Syndrome

The Gougerot-Sjögren's Syndrome|

gougerotsjogren syndrome|2047|16777215|

l+q+g+t+p+w|1|

Lexical Tools: Parallel Flows



Multiple flows can be defined

Lexical Tools: Parallel Flows

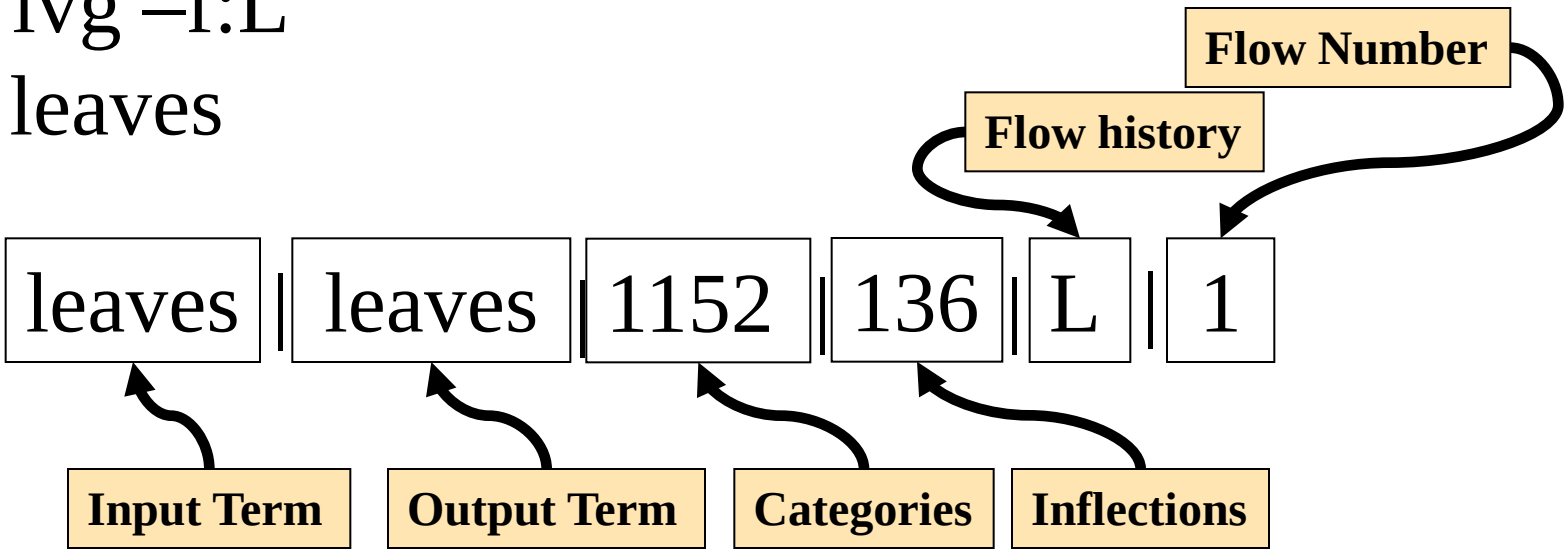
```
> lvg –f:n –f:B:y
ear
ear|ear|2047|1048575|n|1|

ear|aural|1|1|B+y|2|
ear|auricularis|1|1|B+y|2|
ear|otic|1|1|B+y|2|
ear|otor|1|1|B+y|2|
```

First Flow

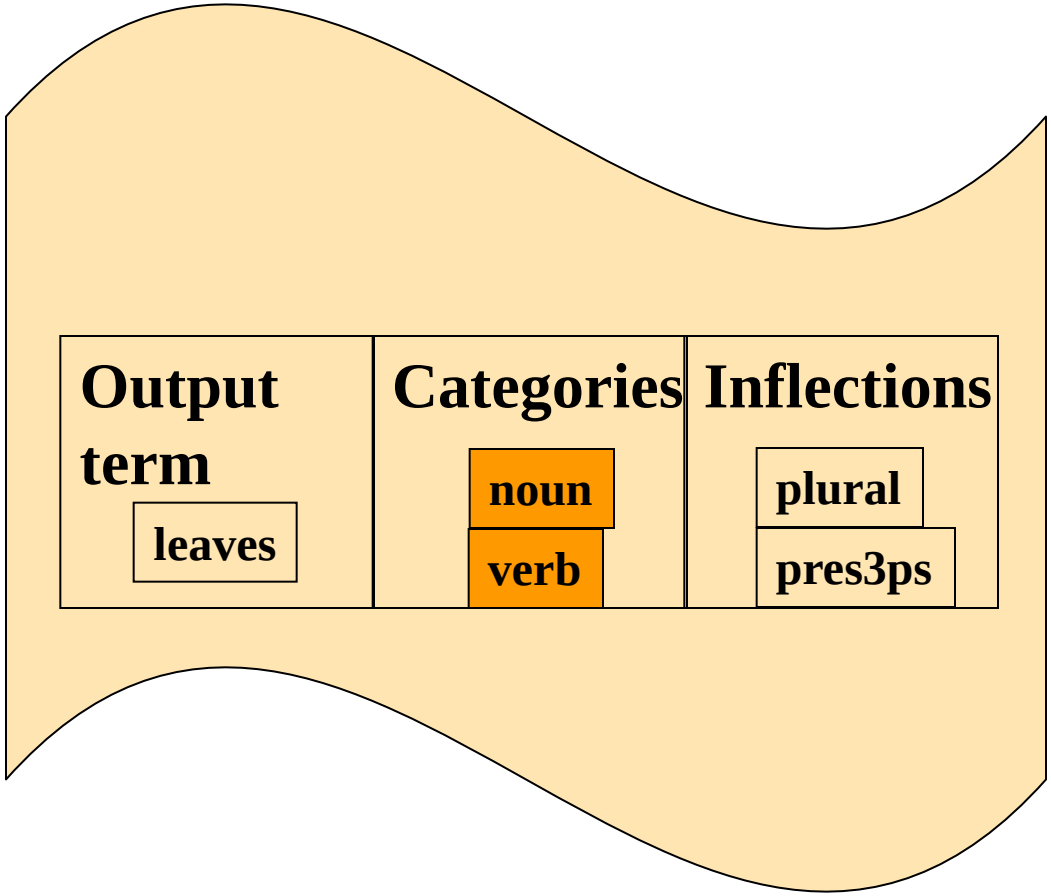
Second Flow

Lexical Tools: Fielded Output

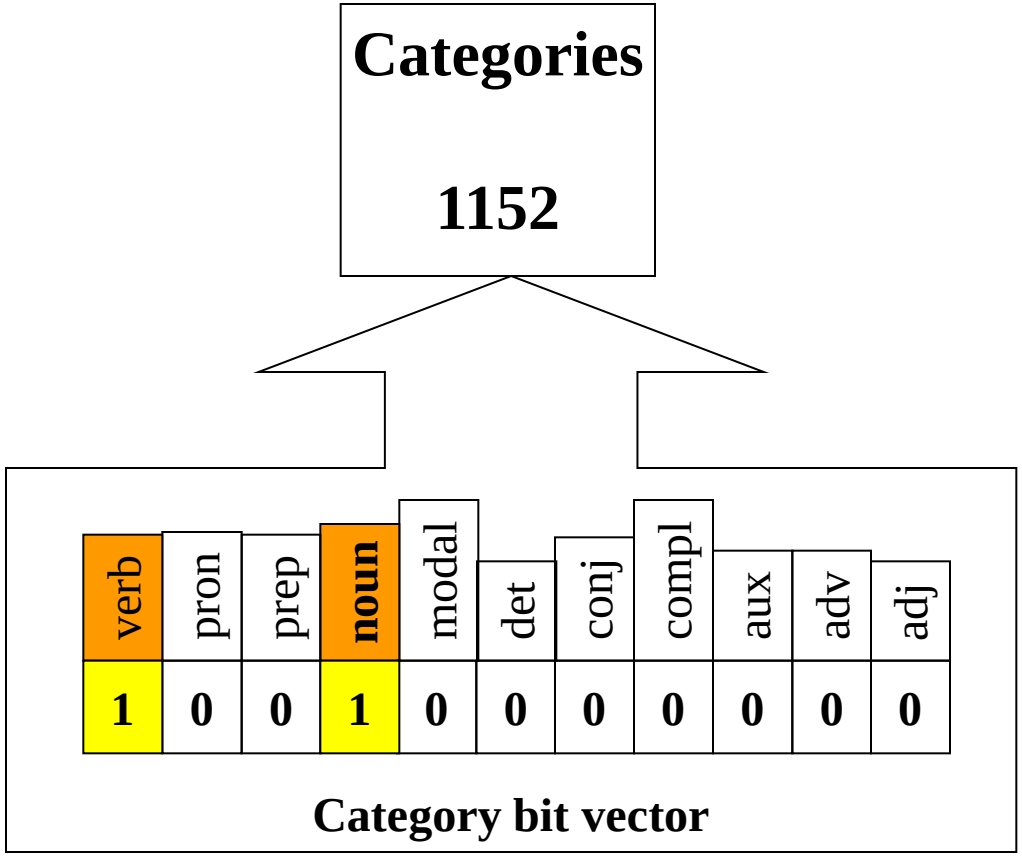
> lvg –f:L
leaves



Lexical Tools: Fielded Output



Lexical Tools: Categories



Lexical Tools: Categories

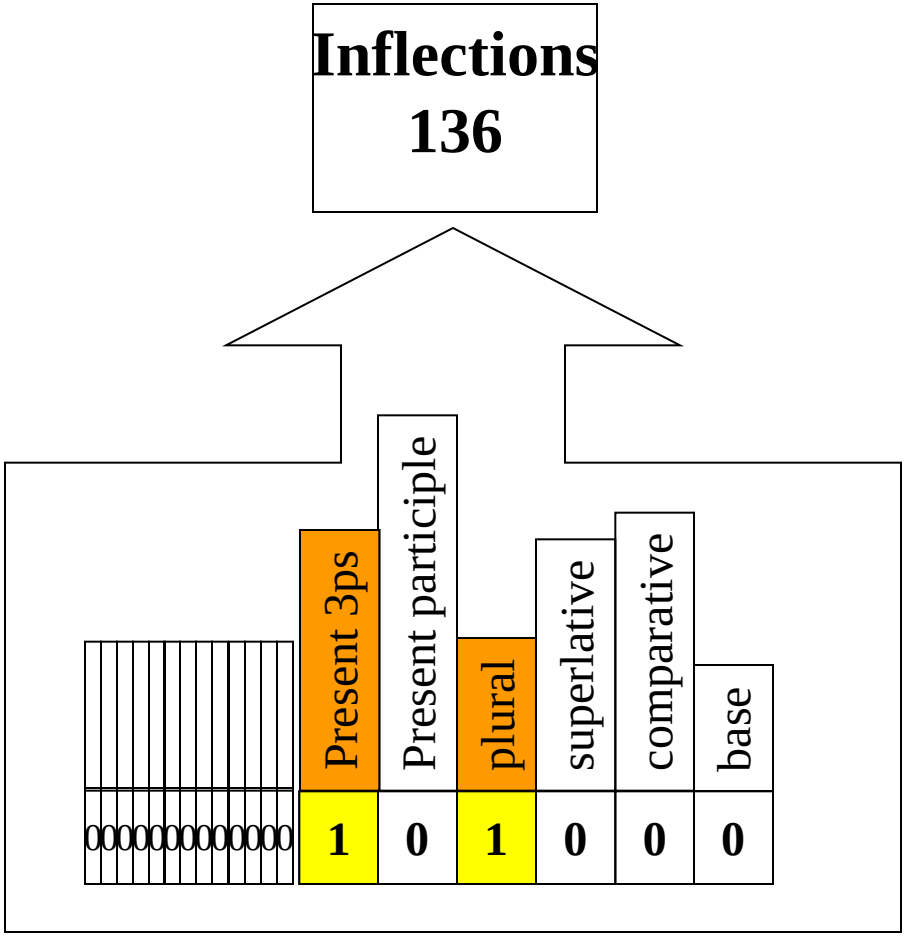
Adjective	1
Adverb	2
Auxiliary	4
Complement	8
Conjunction	16
Determiner	32

Modal	64
Noun	128
Preposition	256
Pronoun	512
Verb	1024

Bit Vector positions →

verb	pron	prep	noun	modal	det	conj	compl	aux	adv	adj
10	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**

Lexical Tools: Inflections



Lexical Tools: Inflections

Base	1
Comparative	2
Superlative	4
Plural	8
Present Participle	16
Past	32
Past Participle	64
Present 3rd Person Singular	128

Lexical Tools: Inflections

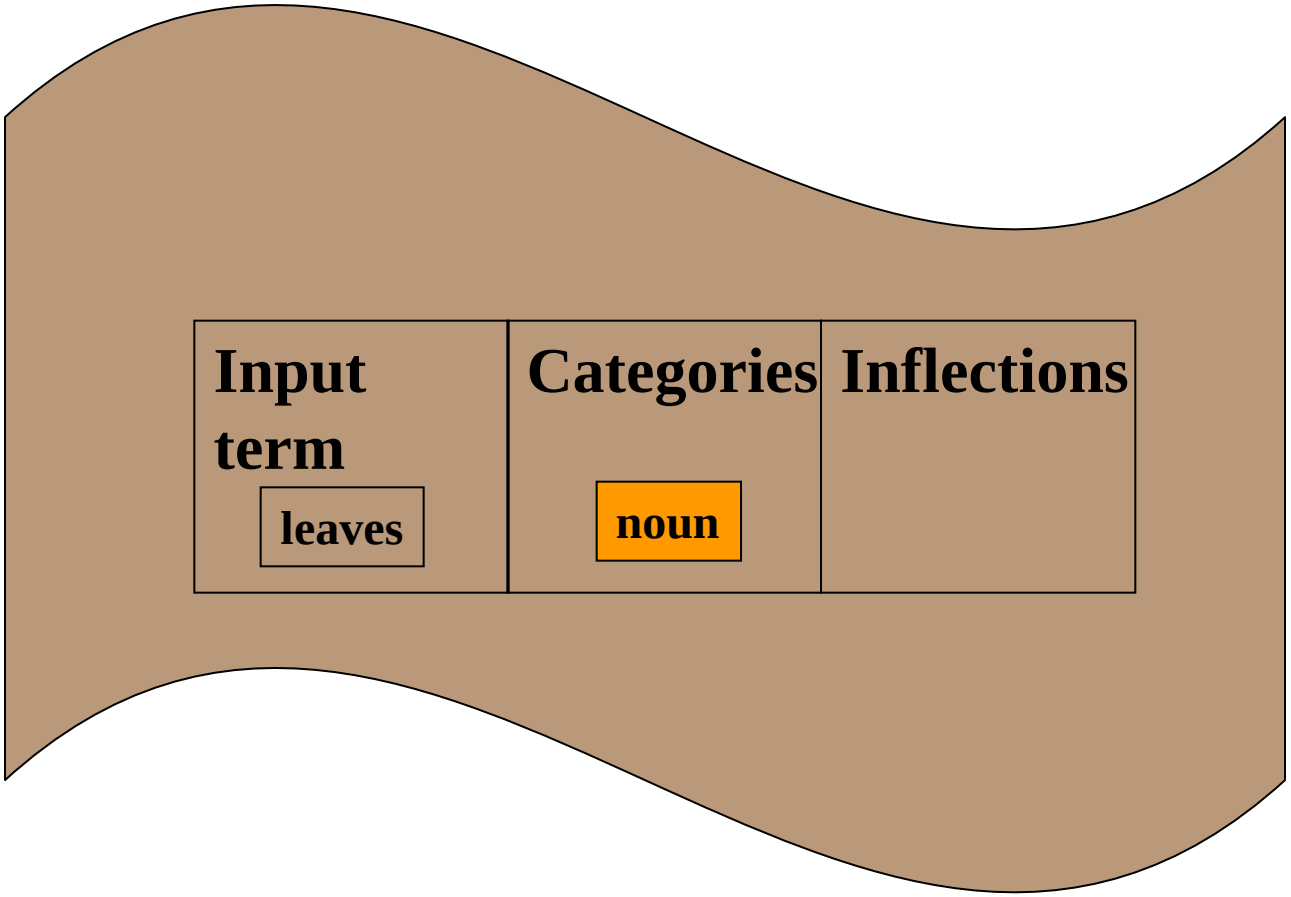
Inflection	Expanded	Mapped
Positive	256	1
Singular	512	1
Infinitive	1024	1
Pres 123p	2048	128
Past Neg	4096	32
pres123pNeg	8192	128
Pres1s	16384	128
past1p23pNeg	32768	32
past1s3sNeg	65536	32

Inflection	Expanded	Mapped
Pres1p23p	131072	32
pres1p23p	262144	128
pres1p23pNeg	524288	128
past1s3s	1048576	32
pres	2097152	128
pres3sNeg	4194304	128
presNeg	8388608	128
all	16777215	255

Lexical Tools: Fielded Output

Input term	Output term	Categories	Inflections	Flow history	Flow number
leaves	leaves	1152	136	L	1

Lexical Tools: Fielded Input



Lexical Tools: Fielded Input

Input term field

Input category field

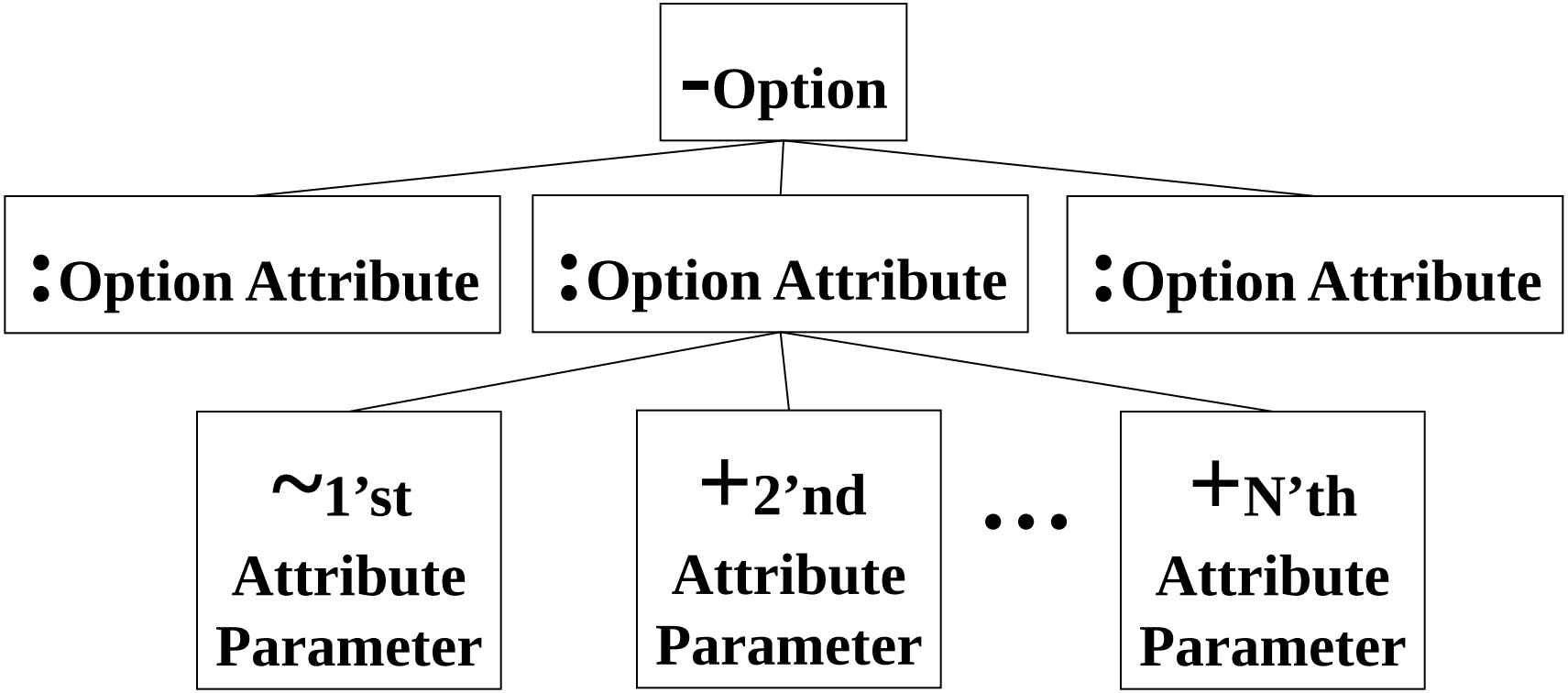
> lvg –f:L **–t**:1 **–cf**:2 -ti

leaves | 128

leaves | leaves | 128 | 8 | L | 1

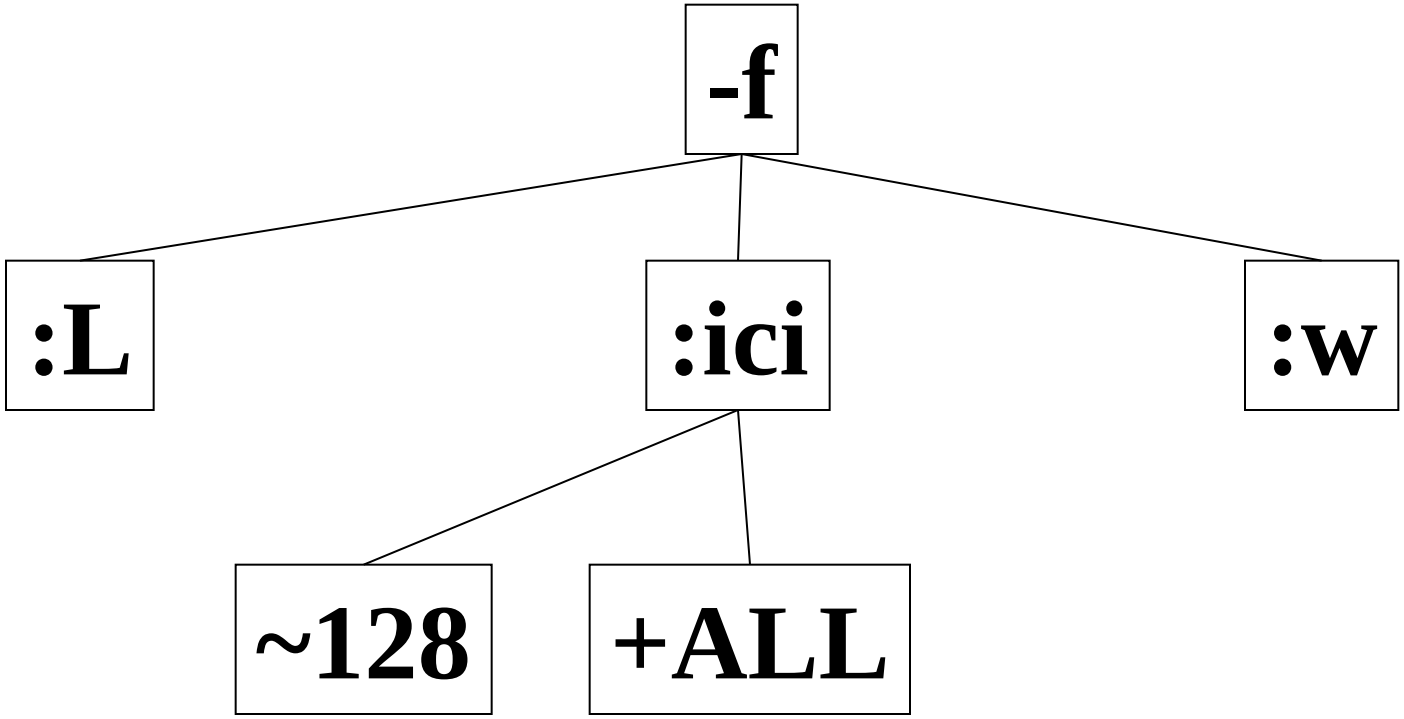
Lexical Tools: Command Line Syntax

- Hierarchical structure

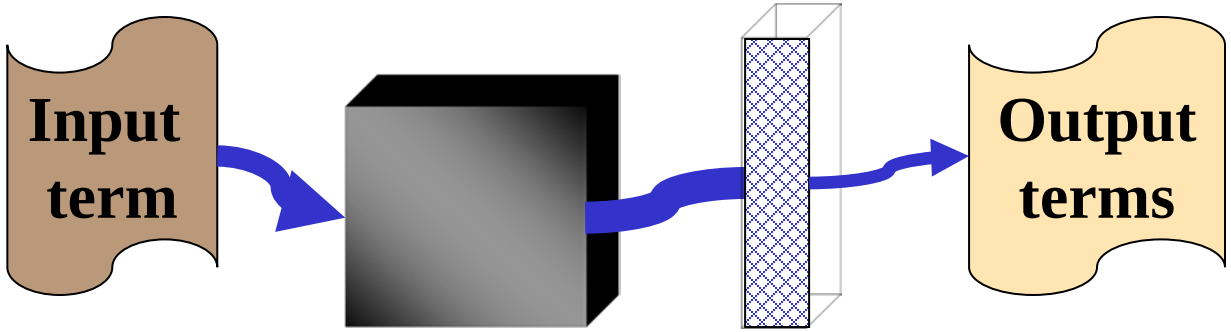


Lexical Tools: Command Line Syntax

-f:L:ici~128+ALL:w



Lexical Tools: Post Flow Options



SC	**Show category names**
SI	**Show inflection names**
ccgi	**Mark the end of the set of variants returned**
F:*Int[:Int]*	**Specify fields for outputs**
ti	**Display the only input term in the output when using fielded input**
R:*Int*	**Restrict the number of variants returned**

Lexical Tools: Post Flow Options

Show category names

Show inflection names

> lvg -f:L **-SC -SI**

Show the category and inflection names

phosphoprotein

phosphoprotein|phosphoprotein|**<noun>**|**<base+singular>**|L|1|

sclerosing

sclerosing|sclerosing|**<adj+verb>**|**<base+presPart+positive>**|L|1|

Lexical Tools: Post Flow Options

Mark the end of the set of variants returned

Mark the end of processing

```
> lvg -f:L -ccgi
behavior
behavior|behavior|128|513|L|1|
__THE_END__
```

Lexical Tools: Post Flow Options

Specify fields for outputs

Display only the 8th and 6th field from the output

> lvg -f:u -t:7 **-F:8:6**

C0035440|ENG|S|L0035434|VW|S0003894|Rheumatic carditis, acute

acute Rheumatic carditis|S0003894

Lexical Tools: Post Flow Options

Display only the input term field when using fielded input

Display only the input term from the fielded input to the output

> lvg -f:u -t:7 **–ti**

C0035440|S0003894|***Rheumatic carditis, acute***

Rheumatic carditis, acute|acute Rheumatic carditis|2047|16777215|u|1|

Lexical Tools: Post Flow Options

Restrict the number of variants returned

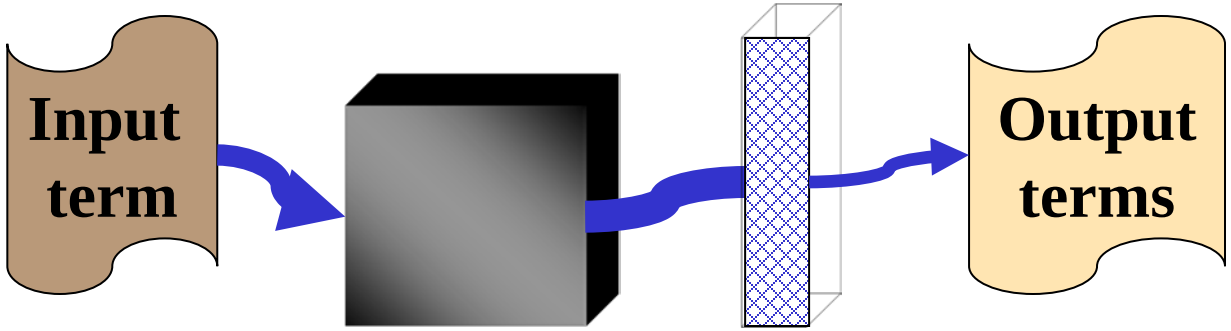
Limit the number of output terms to 2

```
> lvg -f:i -R:2
foo
foo|foo|128|1|i|1|
foo|foos|128|8|i|1|
```

Note: Dangerous!
Do not try this at home!

Note: The unrestricted output would have produced 12 rows otherwise

Lexical Tools: Post Flow Options



EC:*Long*	**Display variants: exclude categories specified**
EI:*Long*	**Display variants: exclude inflections specified**
DC:*Long*	**Display variants that only contain the categories specified**
DI:*Long*	**Display variants that only contain the inflections specified**

Lexical Tools: Post Flow Options

Display variants: exclude categories specified

Display variants, but exclude all terms other than nouns

```
> lvg –f:i –EC:1919
sleep
sleep|sleep|128|1|i|1
sleep|sleep|128|512|i|1
```

Lexical Tools: Post Flow Options

Display variants exclude inflection specified

Display variants, but exclude base forms

> lvg –f:i –EC:1919 **–EI:**1
sleep
sleep|sleep|128|512|i|1

Lexical Tools: Post Flow Options

Display variants contain category specified

Display variants, but only include nouns in the output

```
> lvg –f:i –DC:128
sleep
sleep|sleep|128|1|i|1
sleep|sleep|128|512|i|1
```

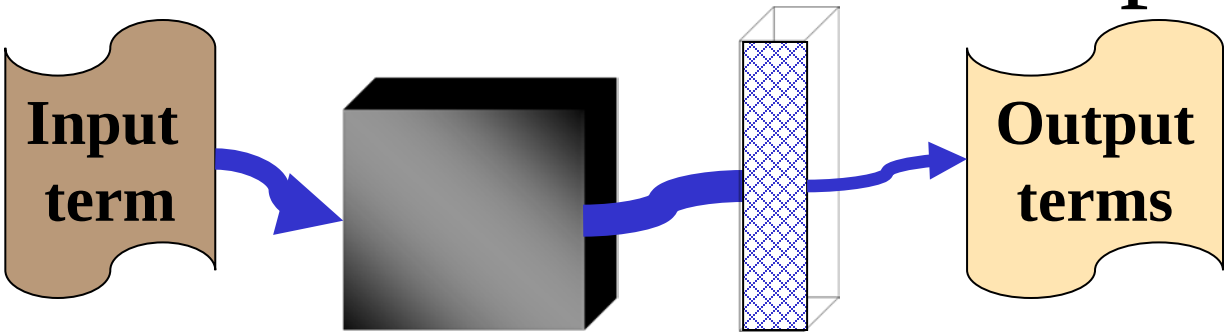
Lexical Tools: Post Flow Options

Display variants contain inflection specified

```
> lvg –f:i –DI:255
sleep
sleep|sleep|128|1|i|1|
sleep|sleep|1024|1|i|1|
sleep|slept|1024|64|i|1|
sleep|slept|1024|32|i|1|
sleep|sleeps|1024|128|i|1|
sleep|sleeping|1024|16|i|1|
```

Display variants, but only include "simplified" inflections

Lexical Tools: Post Flow Options



CR:o	**Combine record by output term**
CR:oc	**Combine record by output term and category**
CR:oi	**Combine record by output term and inflection**
St:o	**Sort outputs by terms in an alphabetical order**
St:oc	**Sort outputs by term and category**
St:oci	**Sort outputs by term, category, and inflection**

Lexical Tools: Post Flow Options

Combine record by output term

Combine records by term

Note: this is a noun+verb

```
> lvg -f:i -CR:o
sleep
sleep|sleep|1152|263681|i|1|
sleep|slept|1024|96|i|1|
sleep|sleeps|1024|128|i|1|
sleep|sleeping|1024|16|i|1|
```

Lexical Tools: Post Flow Options

Combine record by output term and category

Combine records by term and category.

Note: this is both the base+singular inflections combined

```
> lvg -f:i -CR:oc
sleep
sleep|sleep|128|513|i|1|
sleep|sleep|1024|263169|i|1|
sleep|slept|1024|96|i|1|
sleep|sleeps|1024|128|i|1|
sleep|sleeping|1024|16|i|1|
```

Lexical Tools: Post Flow Options

Combine record by output term and inflection

Combine records by term and inflection

Note: This is an adj+adv+noun

lvg -f:b **-CR:oi**
left
left|left|131|1|b|1|
left|leave|1024|1|b|1|

Lexical Tools: Post Flow Options

Sort outputs by terms in an alphabetical order

```
>lvg -f:i -St:o
see
see|saw|1024|32|i|1|
see|see|1024|1|i|1|
see|see|1024|262144|i|1|
see|see|1024|1024|i|1|
see|seeing|1024|16|i|1|
see|seen|1024|64|i|1|
see|sees|1024|128|i|1|
```

Sort by the output term

Lexical Tools: Post Flow Options

Sort outputs by term and category

```
> lvg -f:i -St:oc
left
...
left|left|1|1|i|1|
left|left|1|256|i|1|
left|left|2|1|i|1|
left|left|2|256|i|1|
left|left|128|1|i|1|
left|left|128|512|i|1|
left|left|128|8|i|1|
left|left|1024|64|i|1|
left|left|1024|32|i|1|
left|lefts|128|8|i|1|
```

Sort by the output term and category

Lexical Tools: Post Flow Options

Sort outputs by term, category, and inflection

```
> lvg -f:i -St:oci
see
see|saw|1024|32|i|1|
see|see|1024|1|i|1|
see|see|1024|1024|i|1|
see|see|1024|262144|i|1|
see|seeing|1024|16|i|1|
see|seen|1024|64|i|1|
see|sees|1024|128|i|1|
```

Sort by the output term, category and inflection

Lexical Tools: Flow or Filter

Map the expanded inflections to the simplified inflections

```
>lvg -f:i:Si -CR:oc -St:oci
paint
paint|paint|128|1|i+Si|1|
paint|paint|1024|129|i+Si|1|
paint|painted|1024|96|i+Si|1|
paint|painting|1024|16|i+Si|1|
paint|paints|128|8|i+Si|1|
paint|paints|1024|128|i+Si|1|
```

Lexical Tools: Why Base+Singular

- Base form for Nouns:
  - Singular form
    - There are exceptions:
      - Police

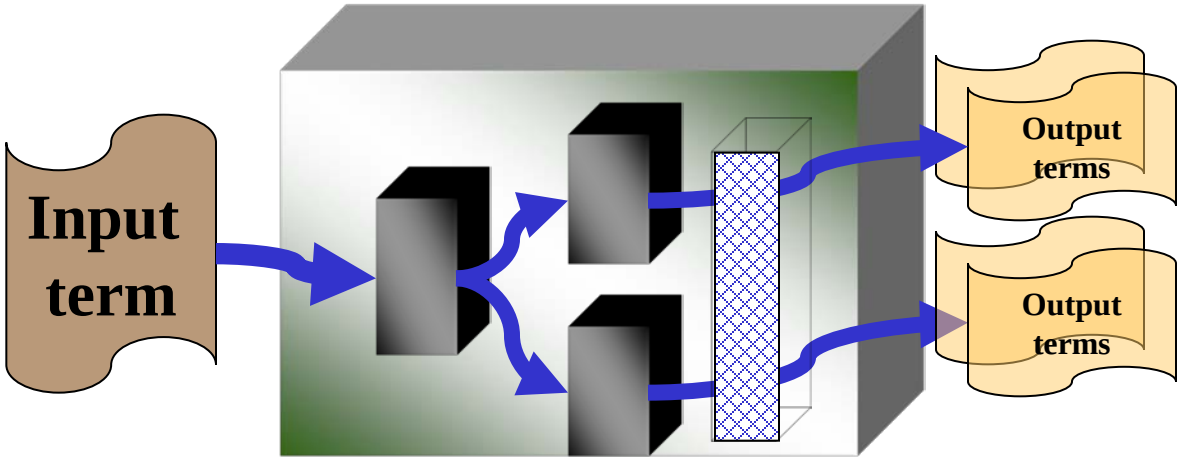
      lvg -f:i -SC -SI -DC:128

      police

      police|police|<noun>|<base>|i|1|

      police|police|<noun>|<plural>|i|1|

Lexical Tools: Global Behaviors



i:*filename*	Define input file name
o:*filename*	Define output file name
x:*filename*	Loading an alternative configuration file
p	Interactive prompt
m	Print extra information of flow mutations
s:*Str*	Defines a field separator.

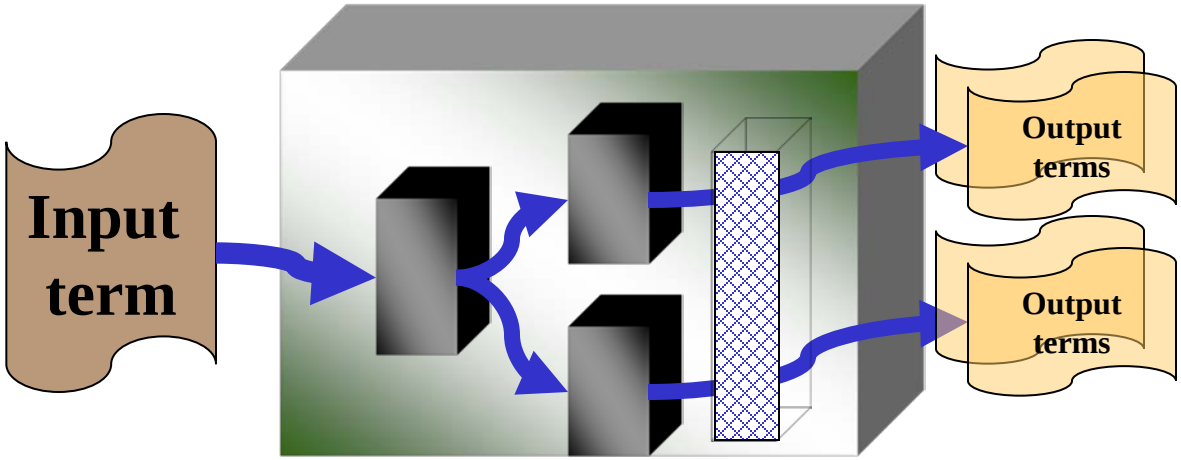
Lexical Tools: Global Behaviors

Interactive prompt

Set the prompt on

```
> lvg -f:s -CR:oc -p
- Please input a term (type "Ctl-d" to Quit) >
color
color|color|128|513|s|1|
color|color|1024|263169|s|1|
color|colour|128|513|s|1|
color|colour|1024|263169|s|1|
- Please input a term (type "Ctl-d" to Quit) >
```

Lexical Tools: Global Behaviors



Kd:*Int*	**Configure the derivation morphology behavior**
Ki:*Int*	**Configure the inflection morphology behavior**

Lexical Tools: Global Behaviors

Configure the derivation morphology behavior

1	**Restrict the output to those variants which are known to the lexicon (default).**
2	**Restrict the output to those variants which are known to the lexicon, unless none of the variants are found in the lexicon, in which case the entire (rule-generated) list is returned.**
3	**No restriction on the output of the morphology. Both facts and rules generated variants are displayed.**

Lexical Tools: Global Behaviors

Configure the derivation morphology behavior

Restrict the derivations to terms that are known to the Lexicon

> lvg -f:d **-kd:**1 -m

breath

breath|breather|128|1|d|1|RULE|$|verb|base|er$|noun|base|

breath|breathlessly|2|1|d|1|FACT|breath|128|breathlessly|2|

breath|breathy|1|1|d|1|RULE|$|noun|base|y$|adj|base|

breath|breathless|1|1|d|1|FACT|breath|128|breathless|1|

Lexical Tools: Global Behaviors

Configure the inflection morphology behavior

1	**Restrict the output to those variants which are known to the lexicon.**
2	**Restrict the output to those variants which are known to the lexicon, unless none of the variants are found in the lexicon, in which case the entire (rule-generated) list is returned (Default).**
3	**No restriction on the output of the morphology. Both facts and rules generated variants are displayed**

Lexical Tools: Global Behaviors

Configure the inflection morphology behavior

> lvg -f:i -m **-ki:3** -R:5 -F:1:2:7:3:4 -SC -SI

Amish

Amish|Amish|FACT|<noun>|<base>

Amish|Amish|FACT|<noun>|<plural>

Amish|Amishs|RULE|<noun>|<plural>

Amish|Amishes|RULE|<noun>|<plural>

Amish|Amishs|RULE|<verb>|<pres>

Return all inflected variants, both fact and rule generated

Lexical Tools: No Operation

-f:n	**Copies the input term to the output with no transformation**

> lvg -f:**n** -f:d -f:y -SC -SI
force
force|**force**|<all>|<all>|**n**|1|
force|forcefully|<adv>|<base>|d|2|
force|forceful|<adj>|<base>|d|2|
force|forcible|<adj>|<base>|d|2|
force|dynamic|<adj>|<base>|y|3|

Lexical Tools: Inflect

-f:i	**Generate inflectional variants**

> lvg -f**:i** -SC -SI

West Nile Virus

West Nile Virus|**West Nile virus**|<noun>|<base>|i|1|

West Nile Virus|**West Nile virus**|<noun>|<singular>|i|1|

West Nile Virus|**West Nile viruses**|<noun>|<plural>|i|1|

Lexical Tools: Inflect

-f:ici~cats+infls	**Generate inflections, filter by cat and/or inflection**

> lvg -f:**ici~128+ALL** -SC -SI

bioassay

bioassay|**bioassay**|<noun>|<base>|ici|1|

bioassay|**bioassay**|<noun>|<singular>|ici|1|

bioassay|**bioassays**|<noun>|<plural>|ici|1|

Lexical Tools: Inflect Simple

-f:is	Generate inflections noting simplified inflection tags

```
> lvg -f:is
cut|cut|1024|1|is|1|
cut|cutting|1024|16|is|1|
cut|cut|1024|32|is|1|
cut|cut|1024|64|is|1|
cut|cut|1024|128|is|1|
cut|cuts|1024|128|is|1|
cut|cut|128|1|is|1|
cut|cuts|128|8|is|1|
```

Lexical Tools: Uninflect by Term

-f:b	**Uninflect by term**

> lvg -f:**b** -SC -SI

left atria

left atria|**left atrium**|<noun>|<base>|b|1|

Lexical Tools: Derivations

-f:d	**Generate derivations**

> lvg -f:**d** -SC -SI

diagnostic

diagnostic|**diagnosis**|<noun>|<base>|d|1|

diagnostic|**diagnostics**|<noun>|<base>|d|1|

diagnostic|**diagnose**|<verb>|<base>|d|1|

diagnostic|**diagnostical**|<adj>|<base>|d|1|

Lexical Tools: Derivations

-f:dc~cats	Generate derivations, filter by category

> lvg -f:**dc~129** -SC -SI

Reduce

reduce|**reducer**|<noun>|<base>|d|1|

reduce|**reduction**|<noun>|<base>|d|1|

reduce|**reducible**|<adj>|<base>|d|1|

Lexical Tools: Synonyms

-f:y

Generate synonyms

> lvg -f:**y** -SC -SI

kidney

kidney|**nephric**|<adj>|<base>|y|1|

kidney|**nephritic**|<adj>|<base>|y|1|

kidney|**renal**|<adj>|<base>|y|1|

Lexical Tools: Normalize (norm)

-f:N

Remove stop words, then remove genitives, then replace punctuation with spaces, then lowercase, then uninflect each word, then take each of the uninflected words, then word order sort.

> lvg -f:N

Syndrome, Dry Eyes

Syndrome, Dry Eyes|**dry eye syndrome**|2047|1|g+o+t+l+B+w|1|

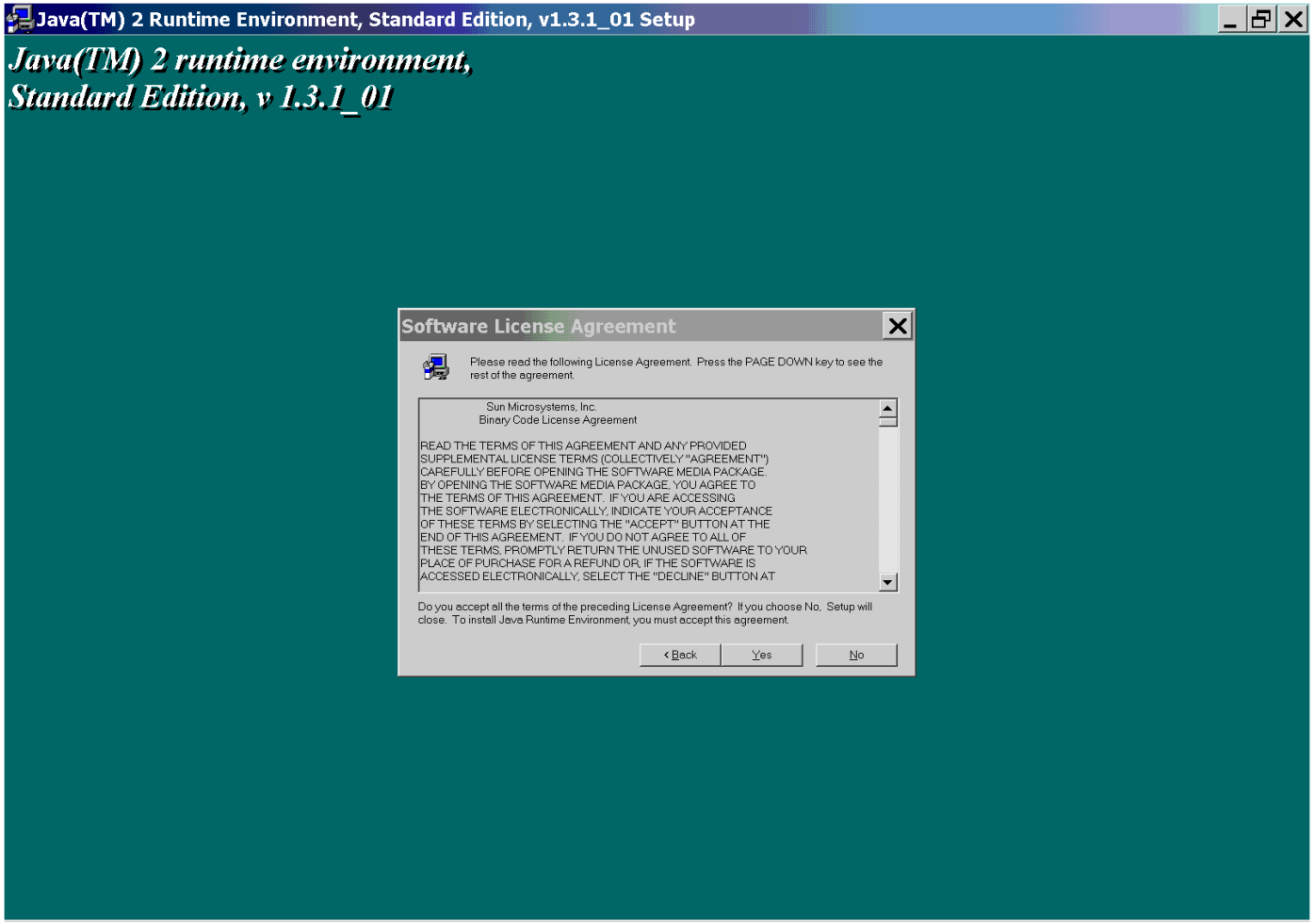
Lexical Tools: Installation

- Requirements
  - 2 gigabytes of space
  - Solaris/NT/Linux
  - Tar, gzip or WinZip
  - Minimum of 36 MB Memory
- Java (1.4) JREs included

Lexical Tools: Installation

```
> ./install/bin/install_solaris_sparc.sh

> .\install\bin\install_win
```

Lexical Tools: Installation



Lexical Tools: Installation

Welcome to the Java Lexical Tools Installation!

Please read the ***installationNotes.html***
prior to invoking this script.

This script will configure the
_LVG_DIR_/data/config/lvg.properties
file.

This script will create configured
lvg, norm, luiNorm, and wordind
scripts in the _LVG_DIR_ directory.

This script, as an option, will configure
and load the lexical tools into a pre-existing
MySql database. This option is only available
if you already have a MySql database running.

~~~
~~~

Lexical Tools: Installation

```
+----------------------Note---------------------------+
|Although we do not support this feature, and it      |
|is very likely that we will change the underlying    |
|implementation, we have found it useful for our      |
|applications to use an existing database system      |
|other than IDB. We often use Mysql as the underlying |
|database for our applications. Since we needed a     |
|way to get the lexical tools data into MySql, we     |
|figured that we would incorporate the MYSQL loader   |
|into this install.                                   |
|                                                     |
|This option requires that an existing mysql database |
|(version 3.23 or higher) have already been installed,|
|that you have database root access privileges,       |
|that the database has enough room to load this       |
|data, and that the database is running now.          |
+-----------------------------------------------------+

+--------------- Question -------------------+
|  Do you want to have the lexical tools use |
|  your mysql database [y/n]  [n]? n
```

Lexical Tools: Installation

```
+-----------------------------------------------+
| Verifying the installation ...                |
+-----------------------------------------------+

Enhydra InstantDB - Version 3.26

The Initial Developer of the Original Code is Lutris Technologies
Inc. Portions created by Lutris are Copyright (C) 1997-2001
Lutris Technologies, Inc.  All Rights Reserved.

Database sample is shutting down...

Database sample shutdown complete.
~~~
```

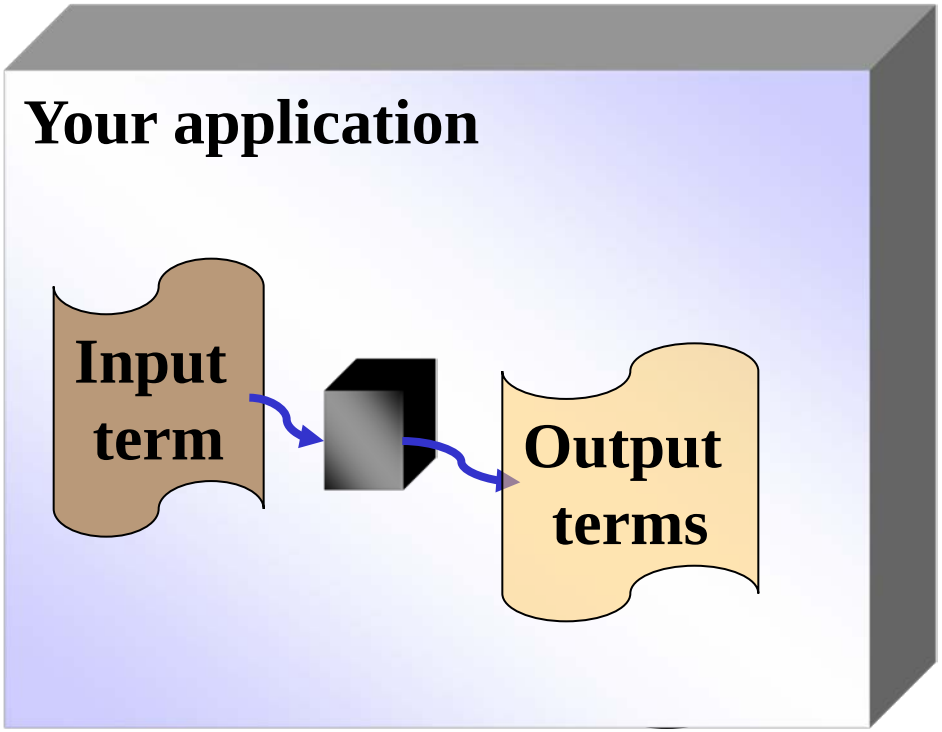
Lexical Tools: Installation

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
                    Congratulations!
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
  This script has completed configuring the java
  lexical tools. You may invoke these tools from a
  command line. These tools are found in the
  __LVG_DIR__/bin directory.
  You can add this __LVG_DIR__/bin path to your
  $PATH environment variable. This would enable
  you to find and run these tools from any location.
  In UNIX, this would be done by adding this
  path to your ~/.cshrc or ~/.profile startup script.

  In Windows, this would be done by appending
  this path to the PATH variable from the
  control panel/System/Environment variables menus.
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
  The lexical tools are ready to be used!
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

Lexical Tools:

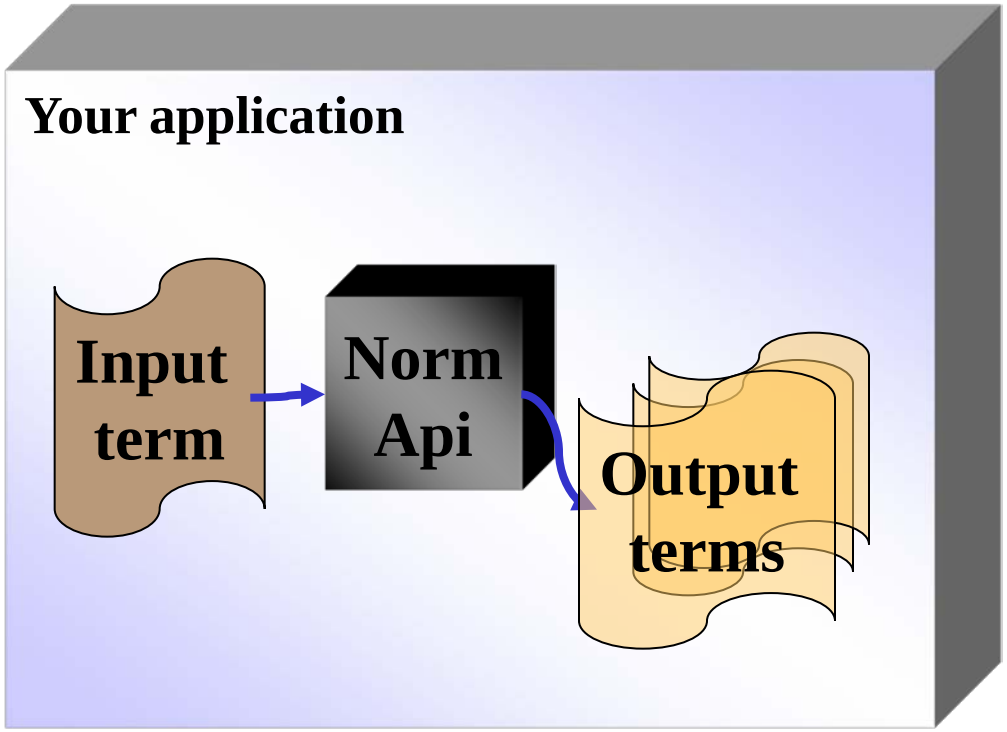
Embedding These Tools into Your Application

- Classpath
- NormApi()
- LvgCmdApi()
- LexItem
- LvgLexItemApi()



Lexical Tools:

Embedding Norm into Your Application



Lexical Tools:

Embedding These Tools into Your Application

```
CLASSPATH = ${CLASSPATH}:
   ${LVG_DIR}:
   ${LVG_DIR}/lib/lvg2003dist.jar:
```

Lexical Tools:

Embedding Norm into Your Application

```
import gov.nih.nlm.nls.lvg.Api.*;

NormApi       normalize = new NormApi();
String        input2Norm = null;
Vector  outputFromNorm = null;
```

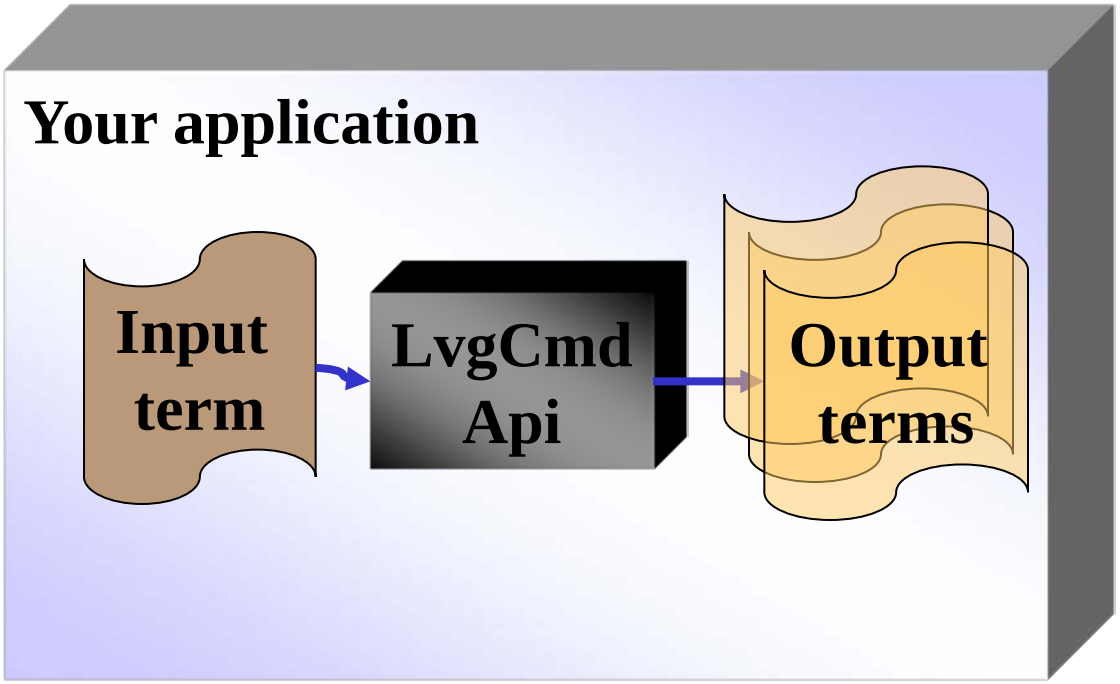
Lexical Tools:

Embedding Norm into Your Application

```
while ( (input2Norm = stdIn.readLine() ) != null ) {

   outputFromNorm= normalize.Mutate(input2Norm);

   for ( int i = 0; i < outputFromNorm.size(); i++ ) {

       System.out.println((String) outputFromNorm.get(i));
    }
}
normalize.CleanUp();
```

Lexical Tools:

Embedding Lvg into Your Application



Lexical Tools:

Embedding Lvg into Your Application

```
import gov.nih.nlm.nls.lvg.Api.*;

LvgCmdApi lvgApi = new LvgCmdApi("-f:b –CR:o –SC –SI");
String          input2Lvg = null;
Vector   outputFromLvg = null;
```

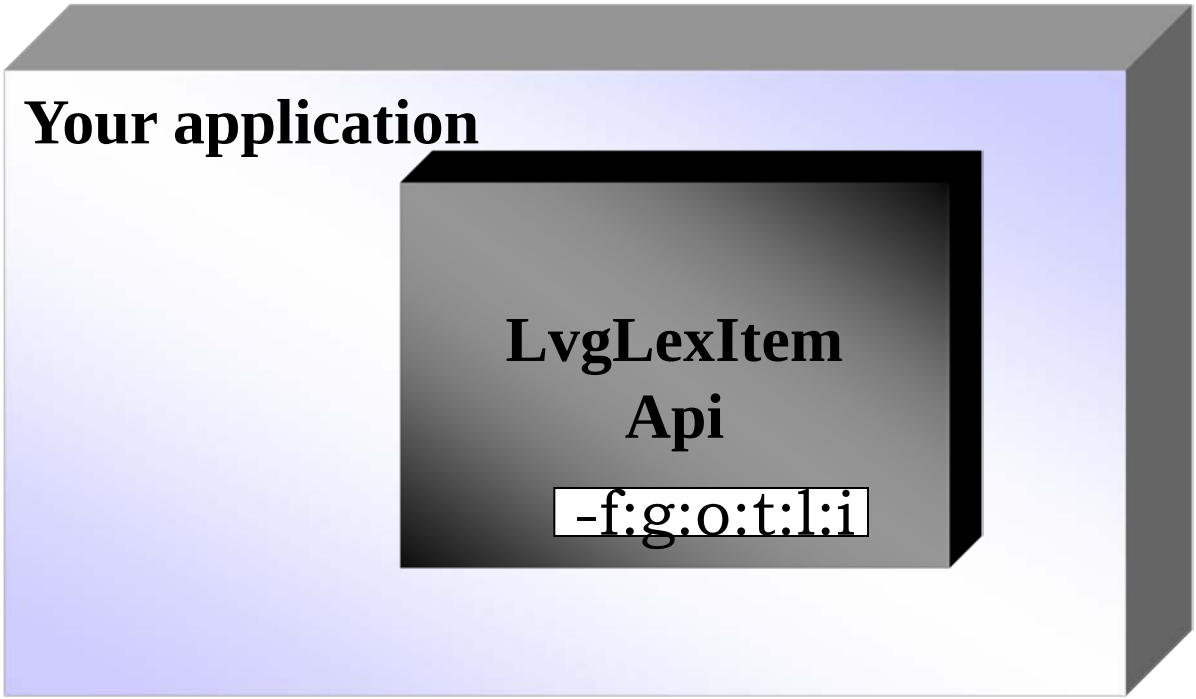
Lexical Tools:

Embedding Lvg into Your Application

```
while ( (input2Lvg = stdIn.readLine() ) != null ) {
   outputFromLvg= lvgApi.Mutate(input2Lvg);
    for ( int i = 0; i < outputFromLvg.size(); i++ ) {
        System.out.println((String) outputFromLvg.get(i));
    }
}
lvgApi.CleanUp();
```

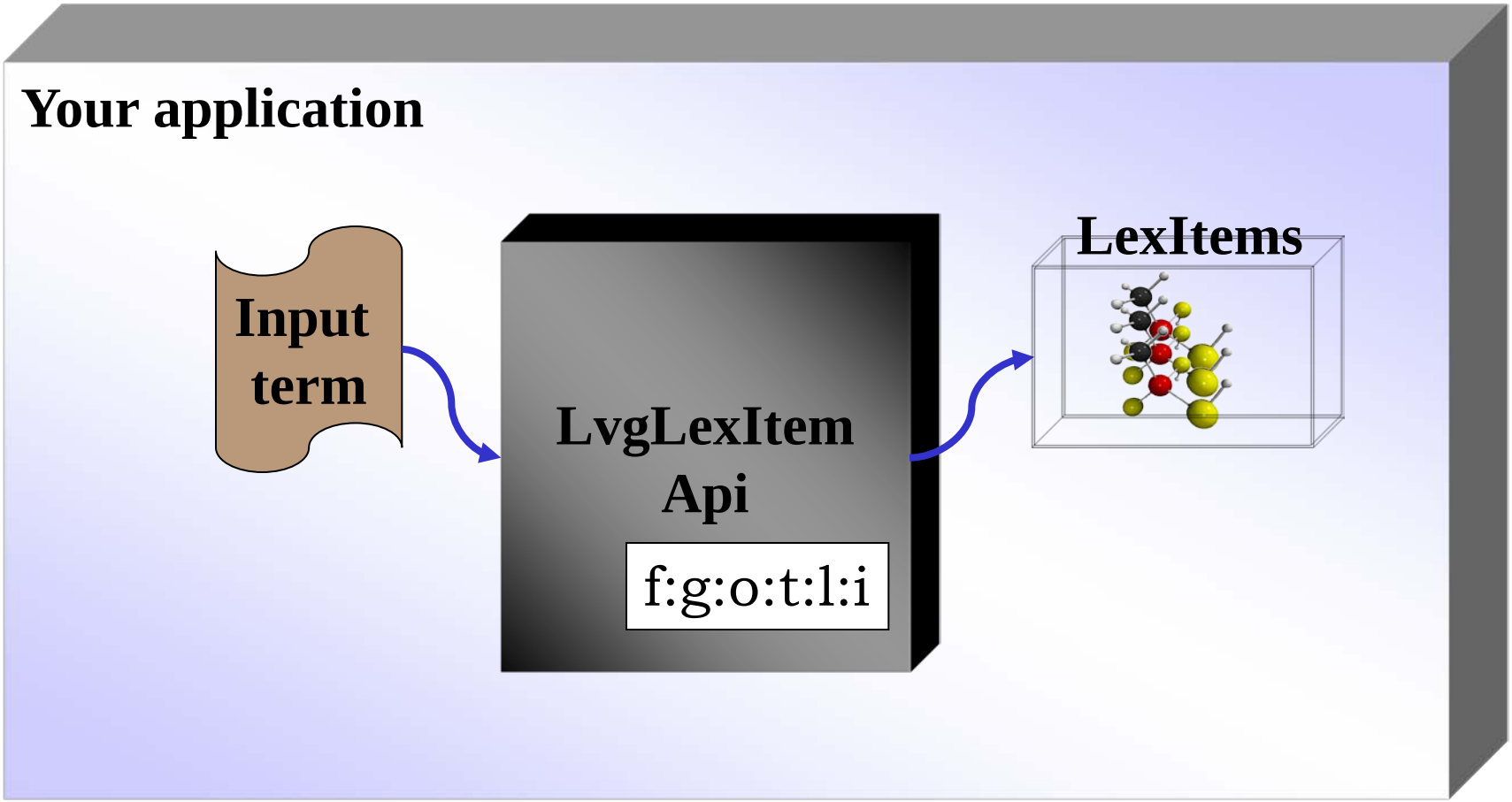
Lexical Tools:

Embedding Lvg into Your Application



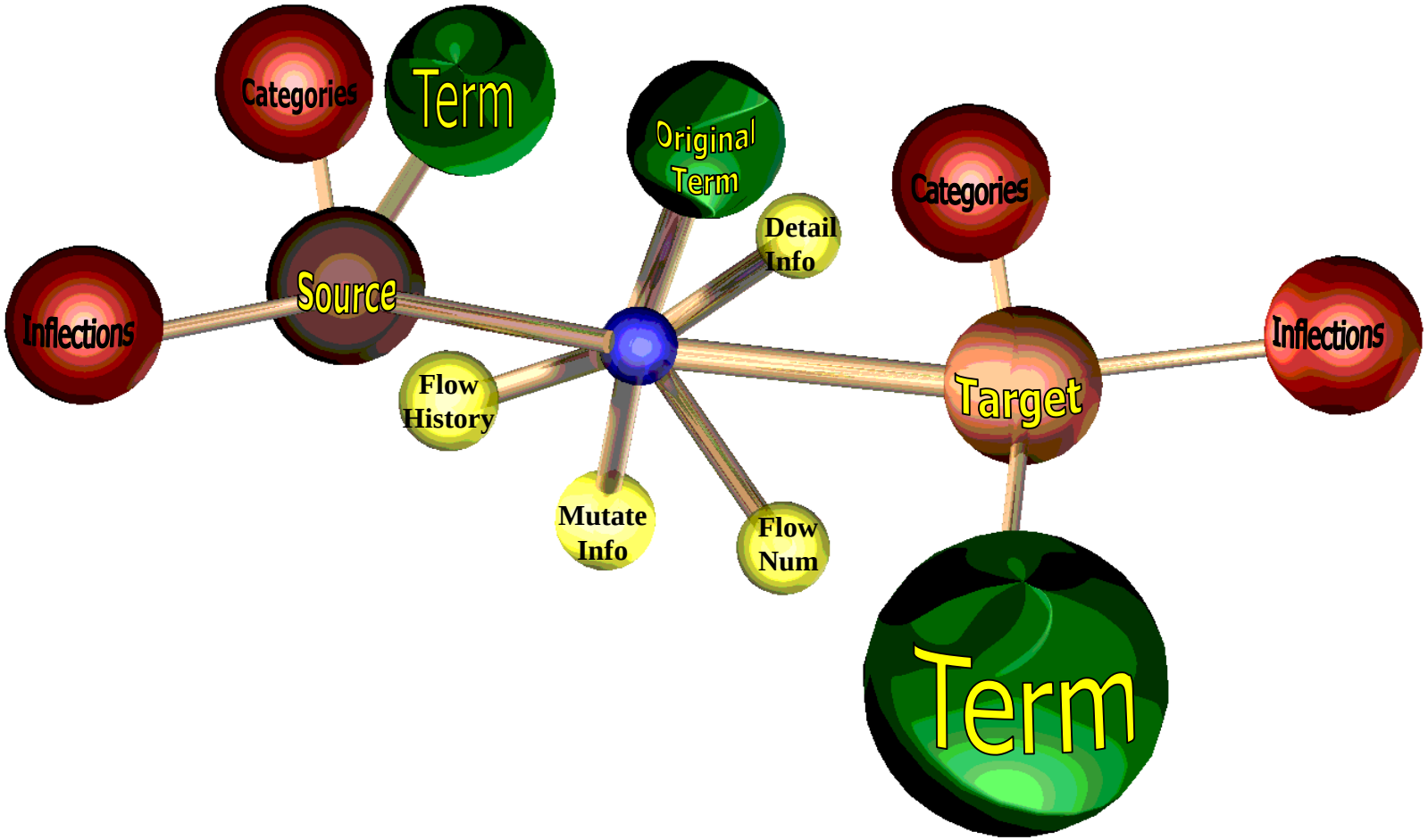
Lexical Tools:

Embedding Lvg into Your Application



Lexical Tools:

The LexItem Class



Lexical Tools:

Embedding Lvg into Your Application

```
import gov.nih.nlm.nls.lvg.Api.*;
import gov.nih.nlm.nls.lvg.Lib.*;

LvgCmdApi    lvgApi = new LvgLexItemApi("-f:g:o:t:l:i");
String          input2Lvg = null;
Vector outputFromLvg = null;
LexItem         aLexItem = null;
```

Lexical Tools:

Embedding Lvg into Your Application

```
while ( (input2Lvg = stdIn.readLine() ) != null ) {

  outputFromLvg=lvgApi.MutateLexItem(input2Lvg);

   for ( int i = 0; i < outputFromLvg.size(); i++ ) {

     aLexItem = (LexItem) outputFromLvg.get(i);
     System.out.println(aLexItem.GetSourceTerm() + "|" +
           aLexItem.GetTargetTerm() + "|" +
           aLexItem.GetTargetCategory().GetName()+ "|" +
           aLexItem.GetTargetInflection().GetName() + "|" +
           aLexItem.GetTargetInflection().GetValue() );
   }
}
lvgApi.CleanUp();
```

Lexical Tools:

Java API Documentation

Packages	
gov.nih.nlm.nls.lvg.Api	This package provides APIs
gov.nih.nlm.nls. lvg.CmdLineSyntax	Provides Java classes necessary to create a command line system.
gov.nih.nlm.nls. lvg.Db	Provides a higher level interface to LVG database.
gov.nih.nlm.nls. lvg.Flows	This package provides API of all Lvg flow components.
gov.nih.nlm.nls. lvg.Lib	Contains LVG general library classes of BitMaskBase, Category, Gender, Inflection, Configuration, CombineRecords, OutputFilter, Flow, GlobalBehavior, LexItem, LexItemComparator
gov.nih.nlm.nls. lvg.Trie	Provides the classes necessary to generate inflections, uninflections, and derivations using LVG rules tries
gov.nih.nlm.nls. lvg.Util	Contains LVG general utility classes of comparators, Bit operations, Case, In, Out, Strip operations, token operation, Char, Str, and Word.

Lexical Resources

UMLS Knowledge Source Server (UMLSKS)

UMLSKS Version 2.1 UMLS Releases: 2002 2002AB

Metathesaurus Semantic Network SPECIALIST Lexicon

Documentation Resources Views/Profiles Logout

The following resources are provided as part of the UMLSKS suite of tools.

Download UMLS Knowledge Sources	Source files for the Metathesaurus, Semantic Network and SPECIALIST Lexicon.
Metathesaurus Resources	Tools and resources for the UMLS Metathesaurus.
NLP and Lexical Resources	Generic configurable Natural Language Processing tools and utilities for manipulating lexical data.

References

McCray AT, Loane RF, Browne AC, Bangalore AK. Terminology Issues in User Access to Web-based Medical Information. Proc AMIA Symp. 1998;:107-111

Divita G, Browne AC, Rindflesch T. Evaluating Lexical Variant Generation to Improve Information Retrieval, Proc AMIA Symp. 1998;:775-9

McCray AT, Browne AC. Discovering the modifiers in a terminology data set. Proc AMIA Symp. 1998;:780-4

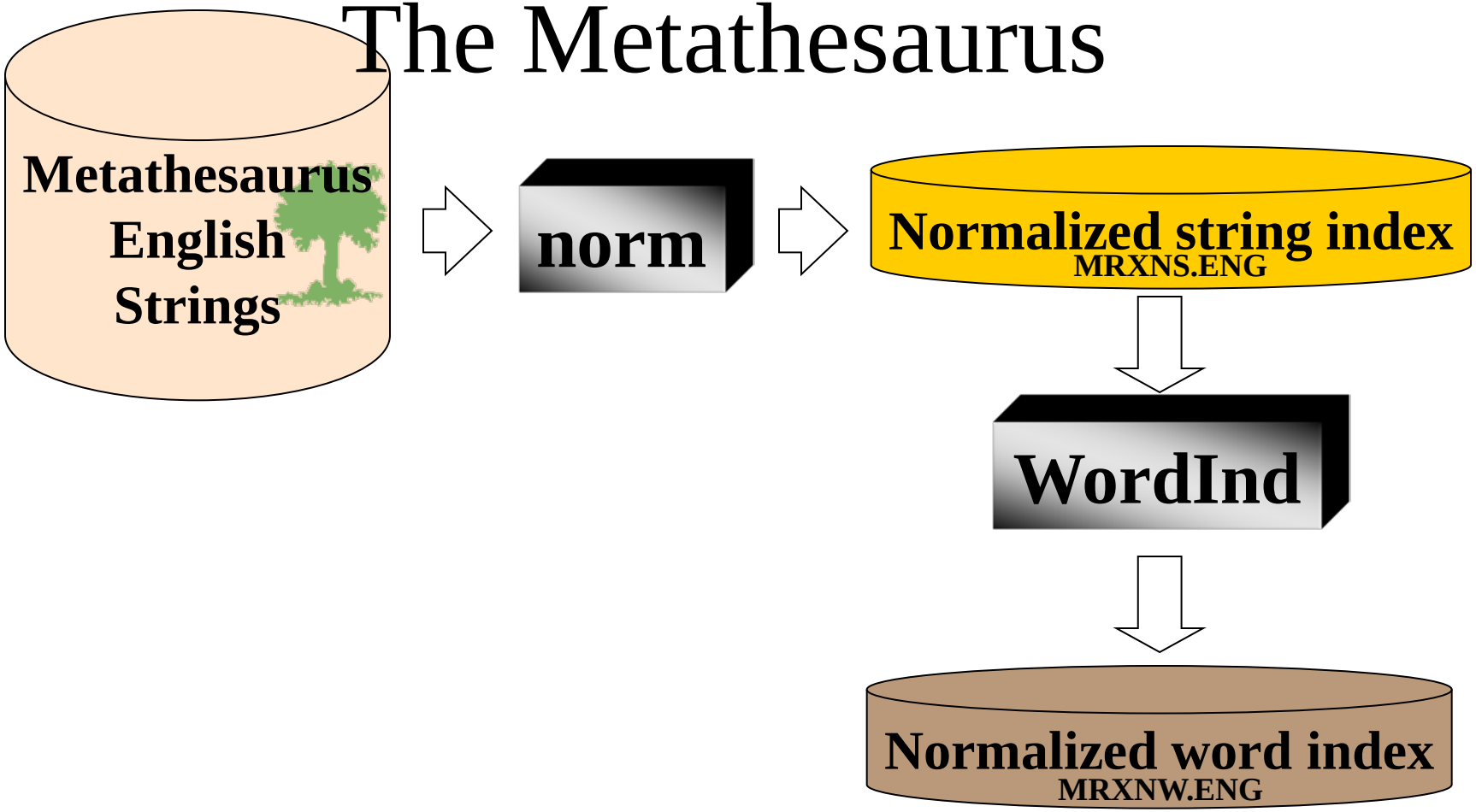
McCray AT. The nature of lexical knowledge. Methods Inf Med. 1998 Nov;37(4-5):353-60.

McCray AT, Cheh ML, Bangalore AK, Rafei K, Razi AM, Divita G, Stavri PZ. Conducting the NLM/AHCPR Large Scale Vocabulary Test: a distributed Internet-based experiment. Proc AMIA Annu Fall Symp. 1997;:560-4.

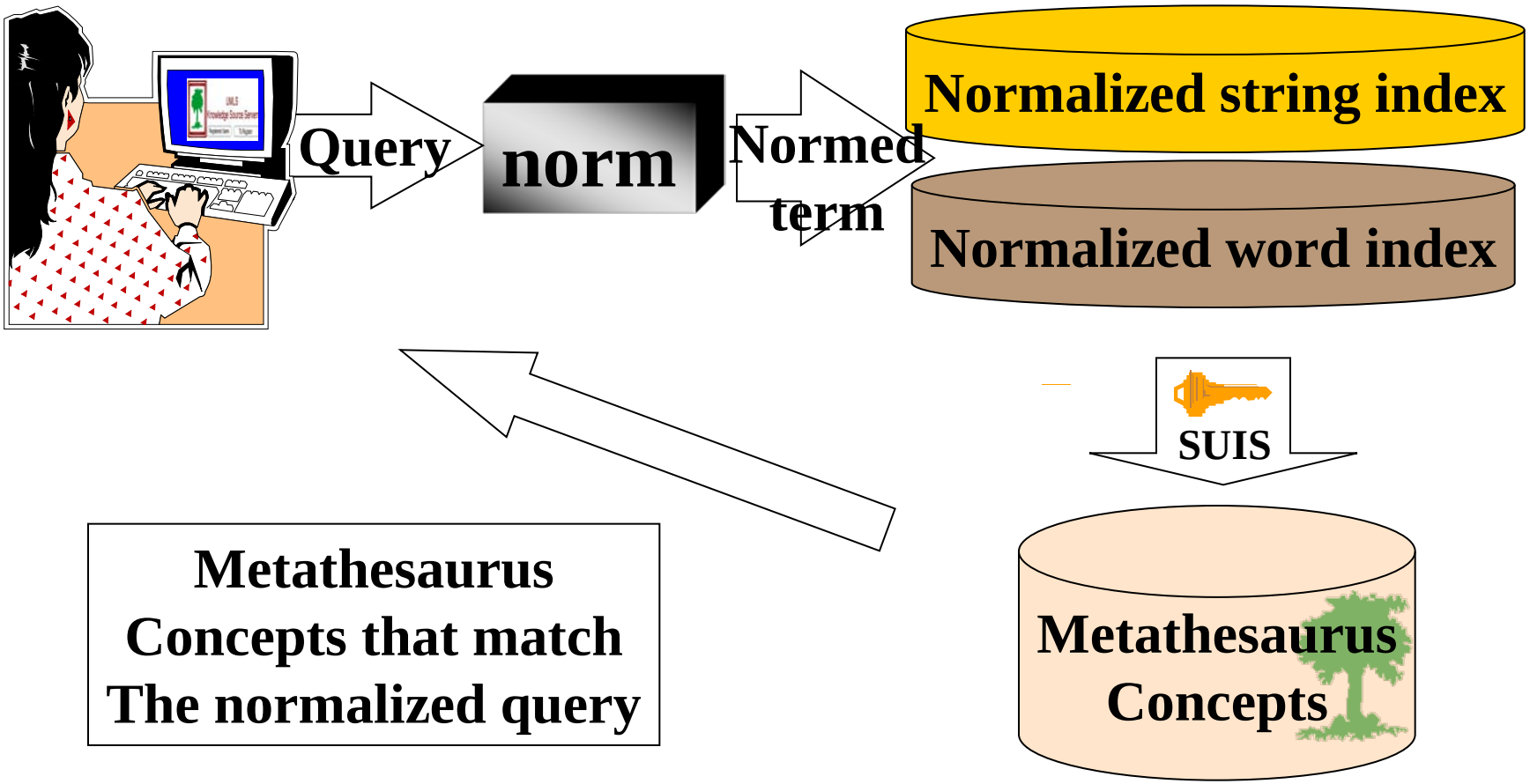
McCray AT, Razi, AM, Bangalore AK, Browne AC, Stavri PZ. The UMLS Knowledge Source Server: A versatile Internet-based research tool. Proc AMIA Symp. 1996;164-8.

McCray AT, Srinivasan S, Browne AC. Lexical methods for managing variation in biomedical terminologies. Proc Annu Symp Comput Appl Med Care. 1994;:235-9.

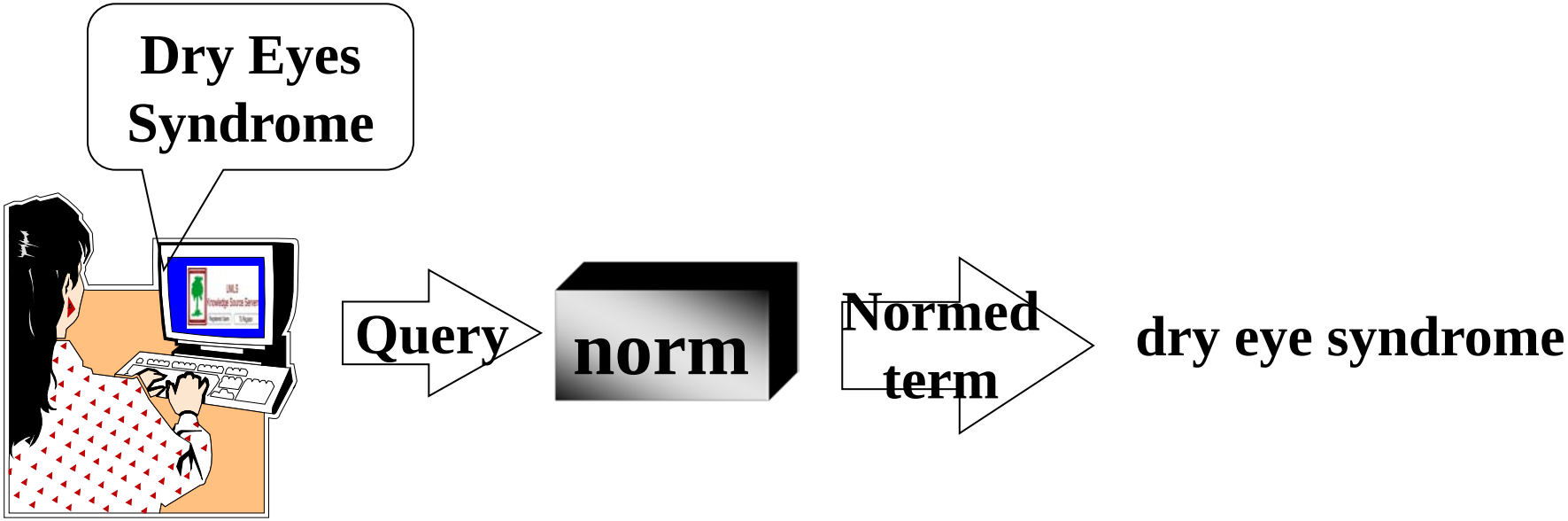
Using The Lexical Tools with The Metathesaurus



Using The Lexical Tools with The Metathesaurus



Using The Lexical Tools with The Metathesaurus



Using The Lexical Tools with The Metathesaurus

Normed term

SUIS

ENG **dry eye syndrome** C0013238|L0013238|**S0004019**|
ENG **dry eye syndrome** C0013238|L0013238|**S0035652**|
ENG **dry eye syndrome** C0013238|L0013238|**S0090228**|
ENG **dry eye syndrome** C0013238|L0013238|**S0090454**|
ENG **dry eye syndrome** C0013238|L0013238|**S0220550**|
ENG **dry eye syndrome** C0013238|L0013238|**S0368350**|
ENG **dry eye syndrome** C0013238|L0013238|**S1459074**|

Using The Lexical Tools with The Metathesaurus

MRCON

SUIS

C0013238|ENG|P|L0013238|PF	**S0035652|**	**Dry Eye Syndromes**
C0013238|ENG|P|L0013238|VS	|S0004019	Dry eye syndrome
C0013238|ENG|P|L0013238|VS	|S0368350	Dry Eye Syndrome
C0013238|ENG|P|L0013238|VS	|S1459074	dry eye syndrome
C0013238|ENG|P|L0013238|VWS	|S0090228	Syndrome, Dry Eye
C0013238|ENG|P|L0013238|VWS	|S0220550	Dry, eye syndrome
C0013238|ENG|P|L0013238|VW	|S0090454	Syndromes, Dry Eye

Building an Index Using The Lexical Tools

- Can we build a tool that increases recall?
- Can we build a tool that increases precision?

Building an Index Using The Lexical Tools

- Can we build a tool that increases precision?
  - Case
  - Constrain by part of speech
  - Filter to the lexicon

Building an Index Using The Lexical Tools

- Can we a tool that increases recall?
  - Include

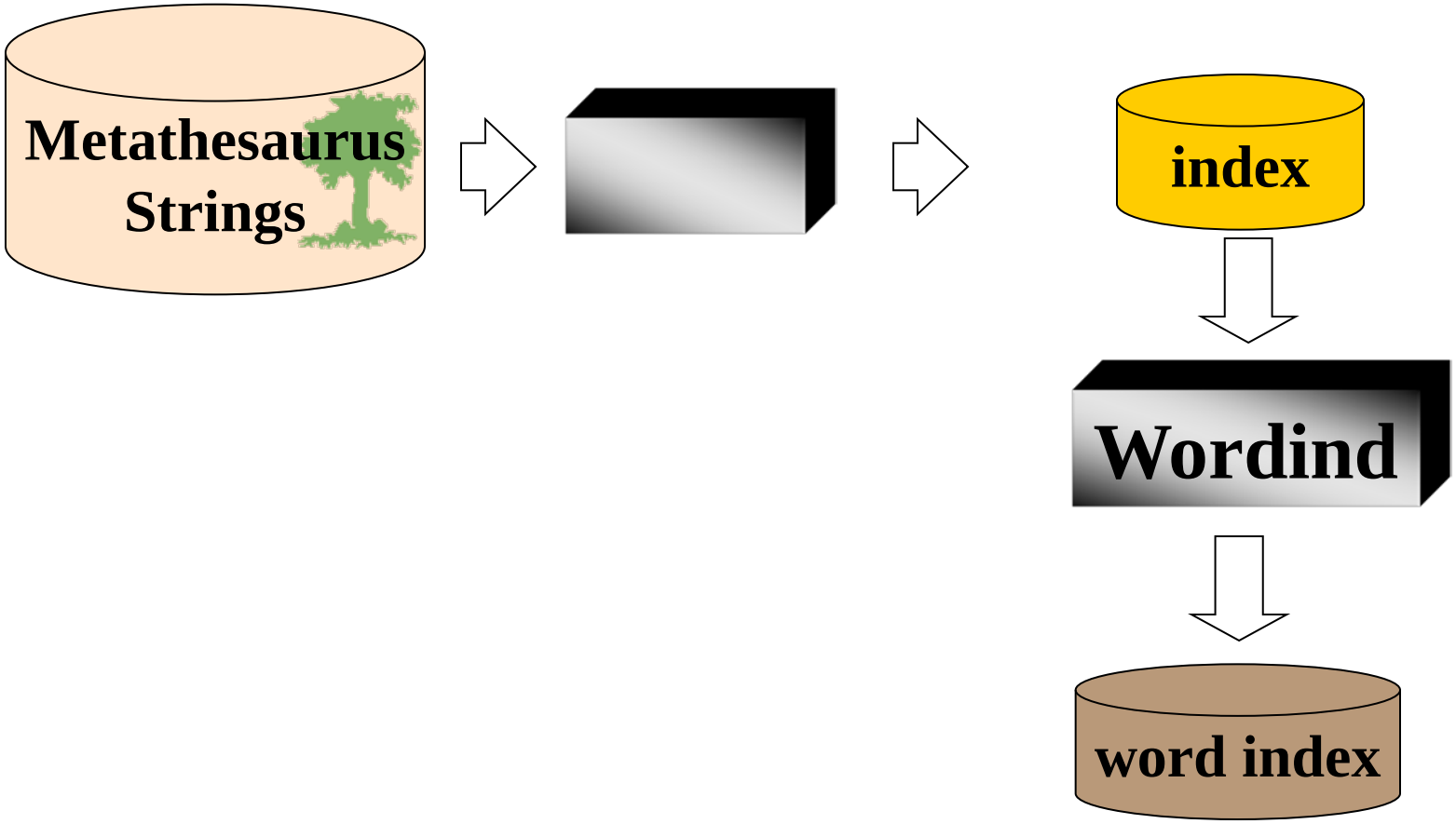
    synonyms

    derivations

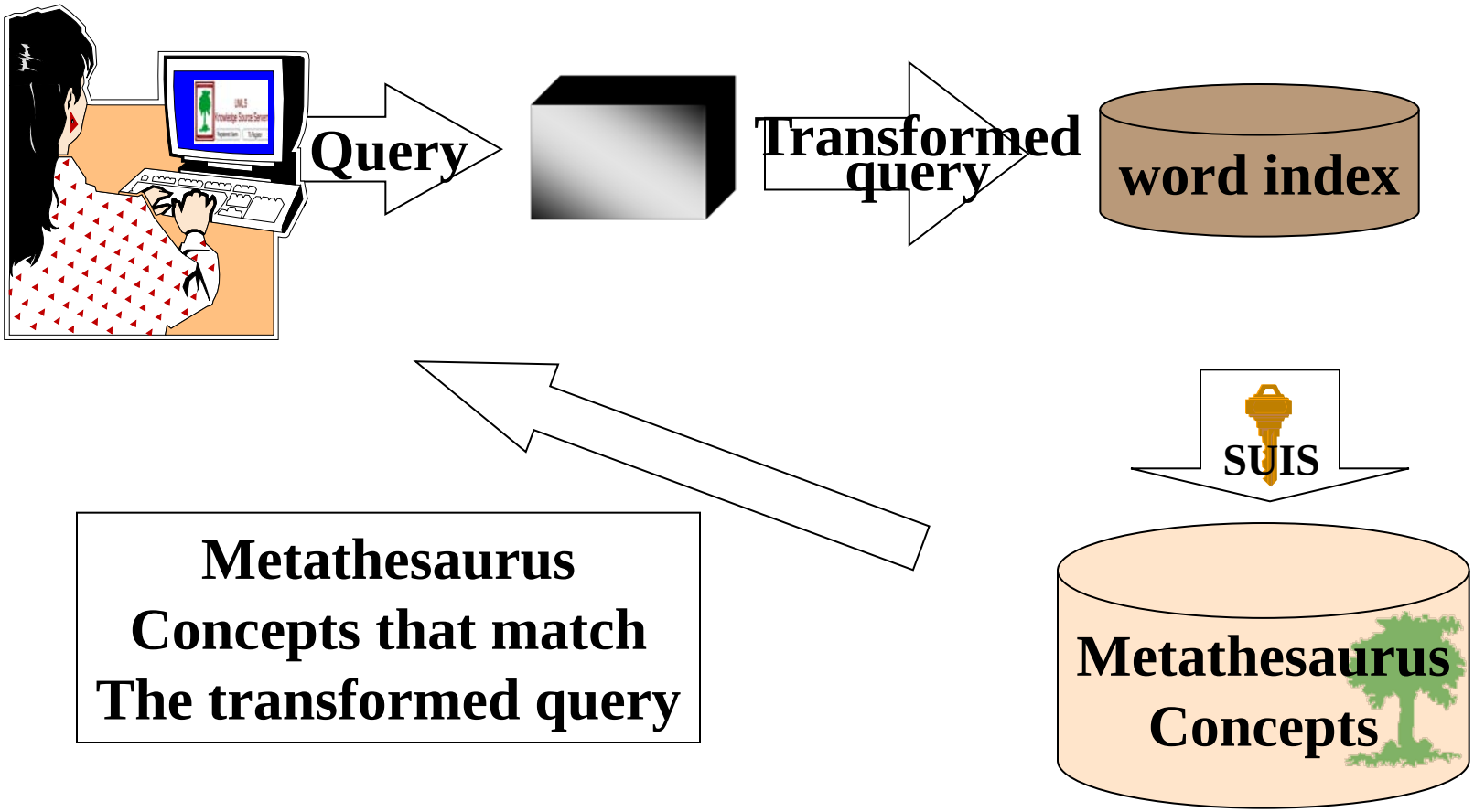
    acronyms and their expansions

    spelling variants

Building an Index Using The Lexical Tools



Building an Index Using The Lexical Tools



Lexical Tools:
2003

- Performance issues addressed
- Graphic User Interface
  - Lexical GUI tool
  - On-line Web based tool
- New flow components
  - Simplify Inflection flows –f:Si, –f:is
- Additional API
  - configuration file parameter in constructor