# Glossa – The Corpus Explorer

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Version 0.9

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# Chapter 1

# Introduction

GLOSSA is a web-based user interface for querying linguistic corpora. It is a front-end for the corpus query engine CWB.[1]

The development aims have been to create a user interface that is both user friendly and flexible. These two goals are not entirely compatible, however, and the resulting compromise does not allow the user the full range of expression in the CWB search language. Therefore, a separate interface has been created where search expressions can be entered directly, while still enabling GLOSSA's features for browsing and postprocessing of results. This will only be necessary for very complex queries, and most users will not need it.

## 1.1 System requirements

Most modern web browsers can be used:

- Internet Explorer

- Mozilla, Firefox, Galeon and the rest of the Mozilla family of browsers

- Opera and Safari (though these are not recommended, due to some minor problems)

There are currently two exeptions:

- Konqueror

- Internet Explorer for the Macintosh

Konqueror should be supported in future versions; but Internet Explorer for Mac seems to have fallen out of use and will not be supported.

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[1] http://cwb.sf.net

# Chapter 2

# Querying monolingual corpora

In it's simplest incarnation, the GLOSSA interface should look like figure 2.1. For multilingual corpora and corpora with bibliograpic databases, there will be some additional options; these will be explained later.

If you type a word into the input field and press «Search corpus», a new window will appear[1]. In our example, we are querying a corpus of Northern Sami. Searching for the word «gaskavuohta» (meaning «relation»), gives us a *results page* (figure 3.1). The contents of the results page will be explained in section 3.

## 2.1 Word options

In addition to simply typing a value in the search field, users can restrict the search further by clicking the «options» button, and selecting values from the menu (figure 2.3). When selected, they appear in a box below the options button (figure 2.4). The options in this box can be removed by double-clicking them.

Most options can optionally be negated; in this case they will appear with a prefixed exclamation mark (figures 2.5and 2.6).

**Search string options**

**Start of word** If "cat" is entered in the search string box and "start of word" is selected, the program will also return "cats", "category" etc.

**End of word** If "cat" is entered in the search string box and "end of word" is selected, the program will also return "housecat", "muscat" etc.

**Middle of word** If "cat" is entered in the search string box and "middle of word" is selected, the program will also return "housecats", "muscatpie" etc.

**Case sensitive** If "cat" is entered in the search string box and "case sensitive" is selected, the program will return "cat", but not "Cat".

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[1]In some browsers, you might have to adjust your settings to allow this.

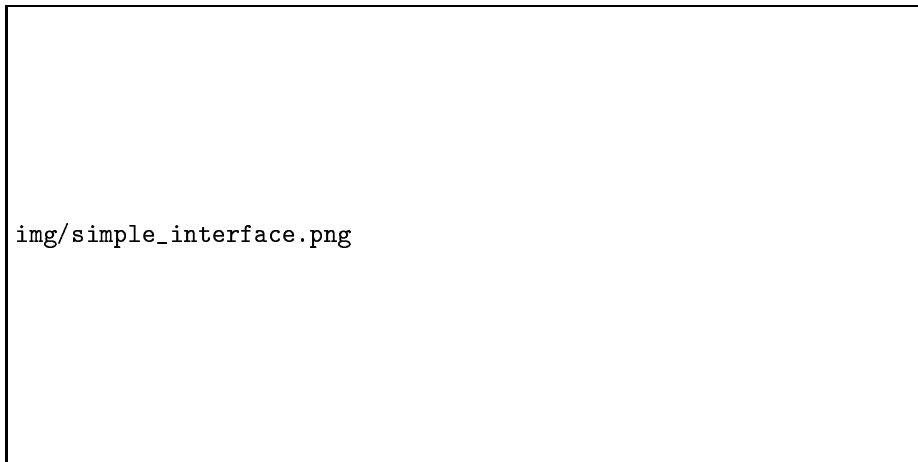img/simple_interface.png
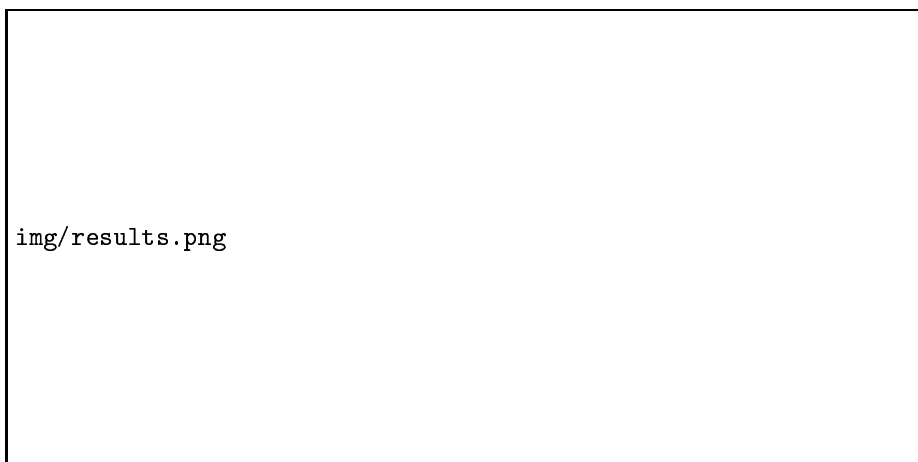
Figure 2.1: Simple interface.

img/results.png
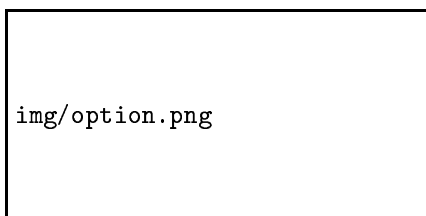
Figure 2.2: Results page.
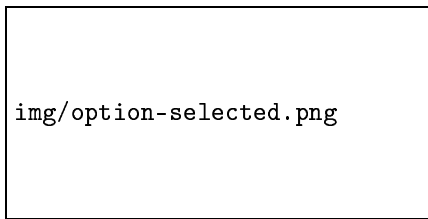
img/option.png

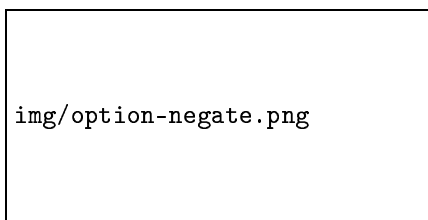Figure 2.3: Selecting an option.

Figure 2.4: Selected option.



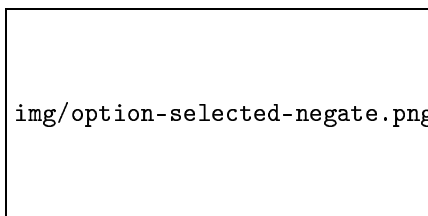Figure 2.5: Selecting a negated option.



Figure 2.6: A negated option.

**Lemma** If "cat" is entered in the search string box and "lemma" is selected, the program will return all forms of the word, i.e. "cat", and "cats".[2]

**Exclude** The program will not return words that match.

**Add word** Adds an alternative word form. If "cat" is entered in the search string box and you select 'add word' and then enter 'dog', you can search for 'cat' *or* 'dog'.

**Add lemma** Adds an alternative lemma form.

**Add word (negated)** Adds a negated alternative word form.

**Add lemma (negated)** Adds a negated lemma form.

### Annotation options

Depending on the degree of linguistic annotation of the corpus you are querying, a range of annotation options are available. Typically, available options will be part-of-speech, morphological features and syntactic functions.

Positive annotation options will be connected by disjunction, negative annotation options with discjunction. Thus selecting "noun", "verb", "!adjective", "!adverb" will return words that are either nouns or verbs, but neither adjectives nor adverbs. More formally:

(2.1)  (noun OR verb) AND NOT (adjective OR adverb)

### Other options

**Occurrences** allows specification of how many times the token can occur. If you enter the word «much», and select «one or more», it will match cases like

(2.2)  It was much much too cold.

## 2.2   Intervals and phrases

An important feature of the GLOSSA system is the ability search very complex phrases. This is done by adding more word boxes, and optinally specifying the lengths of the interwals between them. More word boxes can be added or removed by clicking the buttons with plus or minus signs, on the right side of the screen.

The minimum and maximum interval specifies the number of unspecified words between two query words. If both are left empty, it is assumed that no unspecified tokens can come between the query tokens (i.e. max: zero, min: zero). If the minimum interval is specified, but not the maximum, unlimited maximum interval is assumed. Conversely, if the maximum interval is specified, but not the minimum, a minimum interval of zero is assumed.

Figure 2.7 demonstrates a search for the following phrase:

---

[2]If lemma annotation is present in the corpus.

```
img/phrase.png
```

Figure 2.7: Phrase search.

(2.3)  the lemma "kick"

followed directly by the word "the"

an interval of zero or one unspecified tokens

followed by a noun

The following sentences are some of the ones that matched in a corpus of English texts:

(2.4)  He even repeatedly **kicked the piano**, which he used to be so careful of.

(2.5)  As I had walked part of the way through the fields, I **kicked the caked mud** off my shoes before going in.

(2.6)  People who'd never smoked in their lives hadn't the faintest idea of how difficult it was trying to **kick the habit**, he thought morosely.

(2.7)  They wrenched my arms across my back, forced me down into the cranberry heather and punched and **kicked the way** they were trained.

(2.8)  Stop to **kick the snow** off my boots.

(2.9)  The foreigners whispered to each other, **kicked the blubber** and felt the skins and the walrus tusks.

## 2.3   General options

Below the actual word and phrase queries, we find options for the entire search.

**Using regular expression**

If the regular expressions box is checked, user input will be interpreted as regular expressions: i.e. "." will be interpreted as "one arbitrary character". If it is unchecked, all regular expression characters will be *escaped*: i.e. "." will be interpreted as a period. The regular expression vocabulary is described in Section B.

Queries can sometimes be created faster by typing regular expressions than by selecting items from the menu (eg. typing "house.*" instead of typing "house" and then selecting "start of word" from the menu; typing "house|building" instead of using two query rows). Also, more complex regular expressions cannot be created from the menu.

**Search within**

This parameter restricts the matching of searches containing arbitrary tokens. It can be set to:

**'s'** where all matches will be within the same s-unit. If you corpus contains additional structural markup, like paragraphs, you can use that as well. Refer to the documentation or administrator for the corpus.

**an integer** (for example '10') where all matches will be within the specified number of tokens

If you set the «search within» parameter to 's' and search for «kick» and «bucket» with an unlimited number of unspecified tokens in the phrase query, you will only get results where «kick» and «bucket» is in the same paragraph.

**Hits per page**

The search results are divided into a number of pages; the number of results on each page can be adjusted here.

**Max results**

Searching for common words in large corpora can be slow. Restricting the total number of results can improve response times.

**Randomize**

It this option is selected, the 'max results' option will mean «give me a random selection of the possible hits». If it is not selected, 'max results' will give you the *first* possible hits, in the order they were retrieved in the corpus. The randomize option will possibly give a more representative sample, but might be slower, and has the disadvantage that the same query will give different results each time. If you plan to use the concordance list for statistical purposes, you should always select 'randomize'.

img/kwic.png

Figure 2.8: A KWIC concordance.

**Skip global frequency**

Normally, Glossa will display the total number of times the query is matched in the corpus. However, if you are not interested in this number, selecting 'skip global frequency' will result in faster searches.

**Context**

There are two ways of specifying contexts size shown in the search results: by number of sentences or by number of tokens. If we select `s-units`, the `left` and `right` boxes specify the number of sentences to the left and right of the matching sentence.

Similarly, if we select tokens, we specify the number of tokens to the left and right to the matching phrase. Also, the results are displayed as a traditional KWIC concordance. Figure 2.8 contains a results page with seven words on both left and right side.

## 2.4 Meta information

If your corpus contains meta information (predefined subcorpora, bibliograpic information etc.), GLOSSA supports both viewing this information (described in 3) and restricting searches according to it.

If available, meta-data restrictions will appear below the general options, as illustrated in figure 2.9. Restriction classes can be hidden[3] or displayed with the «+» and «-» buttons.

There are three types of restriction classes: tables, ranges and checkboxes. Using ranges («publication date» in 2.9) and checkboxes («translation» in 2.9) should be straighforward. The tables are used as follows:

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[3]Hiding a restriction class will also reset it, i.e. no constraint on the search will be created.
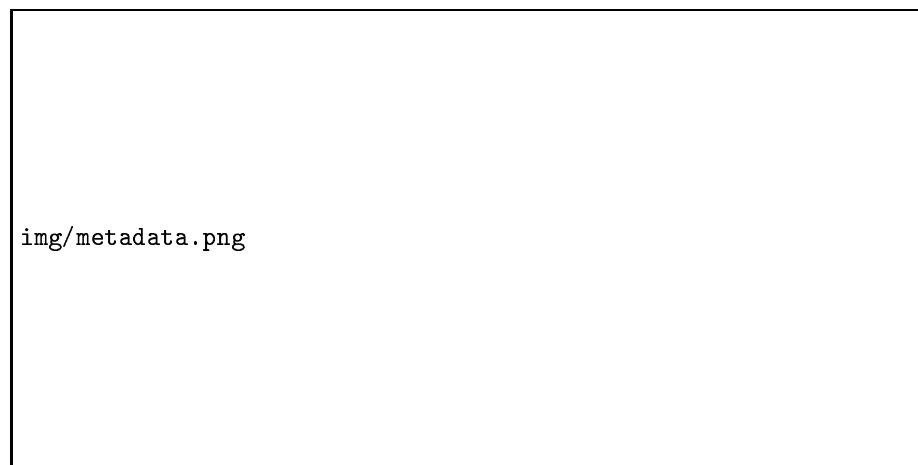
img/metadata.png

Figure 2.9: Meta-data restrictions.

- items are moved from one column to the other eiter by double-clicking them, or by marking one or more and clicking the appropriate arrow button.

- the items in the right column are selected, and the menu under that column is used to specify whether those items should be excluded or chosen. If they are chosen, *only* matches from texts with one of those attributes will be returned; if they are excluded, those matches will *not* be returned.

Figure 2.10 will return matches from texts that:

- has the classcode «Arts» or «Autobiography»

- is *not* published in «Amsterdam» or «Hildesheim»

- is published between 1970 and 1980

- is an original (i.e. not a translation)

To the right of the screen the user will find controls to:

**Show texts** i.e. display a list of texts that will be searched with the current meta-data configuration.

**Save subcorpus** i.e. save the current meta-data configuration for later use.

**Choose subcorpus** i.e. select a previously saved configuration.

## 2.5   Other options

**Display** This drop-down menu allows you to select a value (from the set of metadata) that will be displayed by each concordance line.
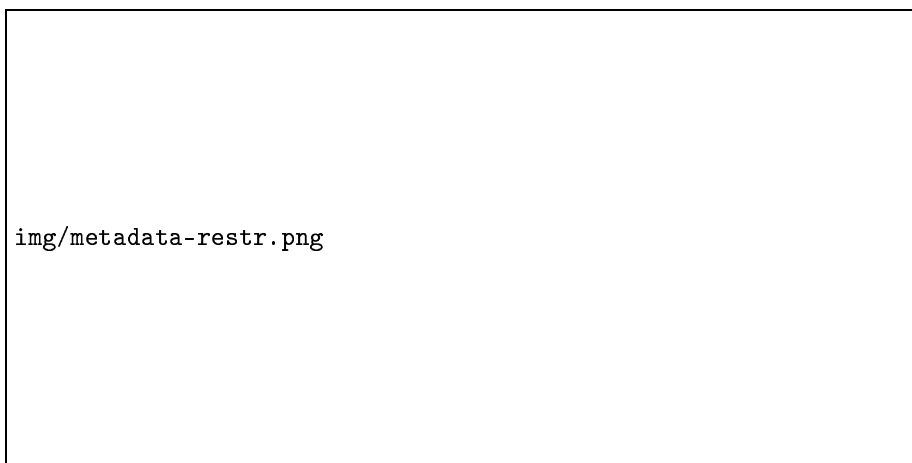
img/metadata-restr.png

Figure 2.10: Restrictions on meta-data.

**Search within** It is possible to search within the results of a previous search. (Currently it is only possible to select the last performed search.) Note that this means searching within the matched phases, not the context.

## 2.6 Keyboard shortcuts

Each corpus may have a set of keyboard shortcuts configured, but some are common for all corpora:

**Ctrl+Shift+L** Word option: lemma form

**Ctrl+Shift+S** Word option: start of word

**Ctrl+Shift+E** Word option: end of word

**Ctrl+Shift+C** Word option: case sensitive

**Ctrl+Shift+N** Part-of-Speech: Noun

**Ctrl+Shift+V** Part-of-Speech: Verb

**Enter/Return** Search corpus

# Chapter 3

# Browsing results

## 3.1 The results pages

The results page consists of:

- The CWB search string.

- The frequencies of each of the tokens in the query (only available for some corpora) if there is more than one token in the query.

- A list of available actions for further processing of the result set (described in section 3.2).

- The number of matches returned and the total numer of matches in the corpus (unless 'skip global frequency' has been selected).

- A list of results pages, with the current page shown in bold.

- The results themselves. Each result then consists of:

  - The sentence id. If this id is clicked, a window appears showing meta-information about the text in which the sentence appears. Additionally, it shows more context (and the user can set the context size to an arbitrary large number).
  - Left context
  - The matching phrase (in bold)
  - Right context
  - Linguistic annotation of each word in the result set; displayed when the mouse is moved over the word

## 3.2 Processing results

In this section, actions for processing results are presented. One action is only applicable to multilingual corpora – co-occurence statistics – and is presented in section 4.3.
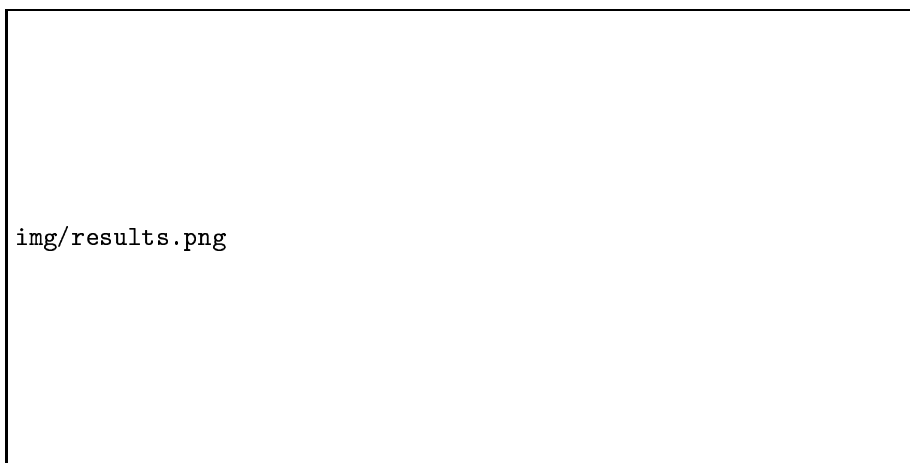
img/results.png

Figure 3.1: Results page.

### 3.2.1 Sort

The sorting function applies to the order of the matches in the results set. The set can be randomized, or sorted alphabetically, according to the source corpus hits, by

- left context

- right context

- matching phrase

- sentence id

When sorting by context or matching phrase, the sorting can be done according to:

- word form

- lemma

- part-of-speech

- any combination of the above

By default, context sorting is done according to the token that is closest to the matching phrase, but the position in context can be set higher by the user.

If the search criteria of two hits are identical, the secondary search criterion applies, with the same options as the primary criterion.

The setup in figure 3.2 will sort the results

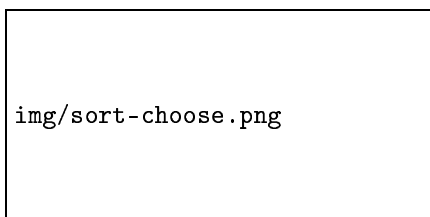1. by the word form on the first word to the left of the match

```
img/sort-choose.png
```

Figure 3.2: Sorting options.
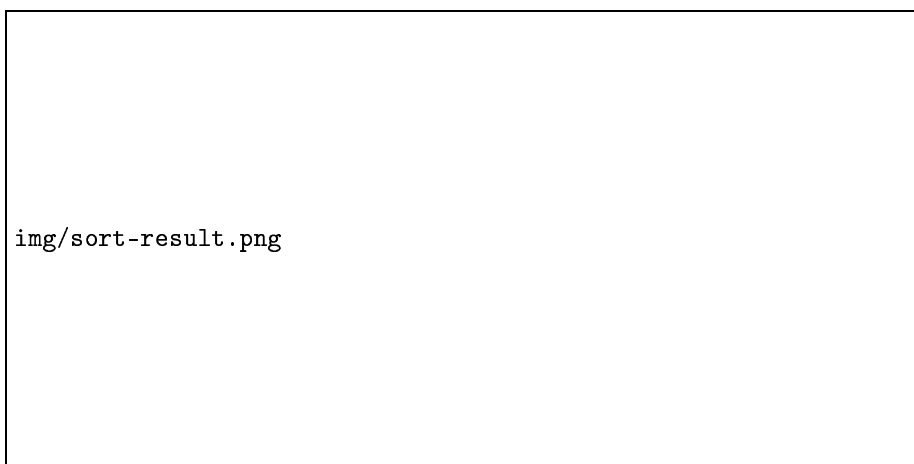
```
img/sort-result.png
```

Figure 3.3: Sorted result set.

2. by the part-of-speech of the first word to the left

3. by the word form of the second word to the left

4. by the part-of-speech of the second word to the left

If all theese criteria are equal, the results will appear in the original order. The start of a result set sorted according to those options are shown in figure 3.3.

### 3.2.2  Lexical statistics

Statistics can be compiled for:

- word form

- lemma

- part-of-speech

- any combination of the above

The results can be presented in any of the following data formats:

- HTML

- Tab-separated values

- Comma-separated values

- Excel spreadsheet

- Histogram

- Pie chart

### Count

This action generates statistics over the matching phrase in the source corpus. Statistics can be generated for

- word form

- lemma

- part-of-speech

- any combination of the above

### Collocations

The collocation function compiles statistics of tokens occurring within a user specified context window of the matching phrase.

The available collocation statistics for bigrams are:

- Frequency (no association measure)

- Dice coefficient

- Fisher's exact test

- Log-likelihood ratio

- Mutual information

- Pointwise mutual information

- Odds ratio

- Phi coefficient

- T-score

- Pearson's chi squared test

The available collocation statistics for trigrams are:

- Frequency (no association measure)

- Log-likelihood ratio

The association measures are described in the Ngram Statistics Package documentation `http://search.cpan.org/dist/Text-NSP/Docs/Measures.pod`.

Note that only first word in the matching phrase is used. Thus if any of the matching phrases contain more than one word, the right-side statistics will contain errors.

Normally, the association values will be computed based on the result set.For some corpora, however, it is possible to select the 'use global statistics' option, which will give much more reliable association statistics, since the whole corpus is taken into account.

### 3.2.3 Deleting hits

### 3.2.4 Saving result sets

The entire result set can be saved. This can be done in either of two ways:

- download to disk

- store on server

**Download**

Optionally, additional meta-data may be included in the downloaded result set. The text in the result set can include

- word form

- lemma

- part-of-speech

- any combination of the above

**Store on server**

### 3.2.5 Annotating hits

### 3.2.6 Meta-data

**List texts**

Information about the text that where applicable for matches in the query can be displayed using this action. Note that this is the texts for which matches could have been returned; not the ones from which matches were actually returned.

**Distribution**

This function displays the number of hits, sorted according to the categories of meta-data available, including information about the number of hits per thousand words.

## 3.3 Multi-modal corpora

When browsing results from multi-modal corpora, one or two additional icons are displayed, for sound and for video. These icons link to a separate module for navigating audio/video content. (Documentation to come.)

# Chapter 4

# Querying multilingual corpora

Exploring multilingual corpora with GLOSSA is very similar to exploring mono-lingual ones:

- some extra options in the search builder

- some extra information in the results page

- one extra option for processing results

## 4.1  Phrase options

If the corpus is multilingual, each phrase in the search builder has some extra options (figure 4.1).

Notice first that each phrase has an option for *language*. The language selected for the first phrase always constitutes the BASE CORPUS. This corpus will be searched first, and search expressions for all other languages – considered ALIGNED CORPORA – will be mached against the aligned regions of the maches of the base corpus. When you change the language of the first phrase, you change which corpus is considered base corpus.
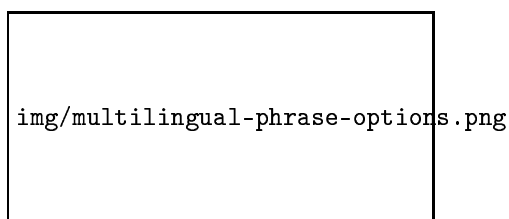


Figure 4.1: Multilingual search.

**Optional alignment**

Glossa will display aligned regions for all aligned corpora. If you leave the search options empty, it will by default create a constraint of *at least one, unspecified token.* This means that if there are parts of the base corpus that does not have aligned regions in one of the aligned corpora, results from those regions will not return matches. This behaviour can be changed by clicking on the «optional alignment» checkbox: The program will return matches from the base corpus, even if there is no aligned regions for that aligned corpus.

**Negation**

Search phrases for aligned corpora can be specified to be negative or positive – using the menu next to the language selector – while base corpus phrases can only be positive.[1]

**Relation between query phrases in aligned corpora**

If more than one query phrases (see Section **??**) are specified for the same aligned corpus, a new menu appears, allowing us to set the logical relation between them:

**conjunction** all of the phrases must occur

**disjunction** at least one phrases must occur

You can select more than one phrases for the base corpus as well, but these can only be disjuncted.[2]

## 4.2 Browsing results

The results pages are identical to the results pages for monolingual corpora, except that aligned regions appear under each base corpus match, in gray color (figure 4.2).

## 4.3 Processing results

The co-occurrence functions provide statistics of the words in the target corpus hits.

## 4.4 Miscellanea

Context size for aligned corpora cannot be set; it is always the region or regions aligned to the matching sentence.

Meta-information applies to the base corpus, not the aligned corpora.

---

[1] This is a result of limitations in CQP.
[2] This is a result of limitations in CQP.
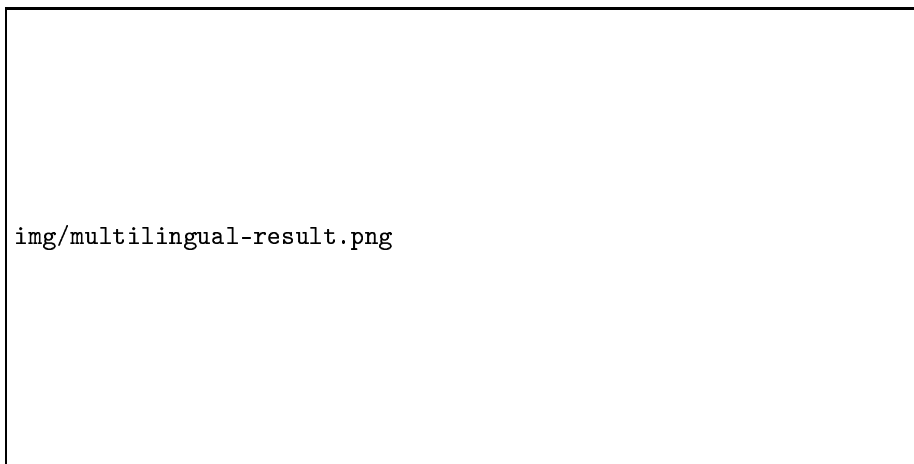
img/multilingual-result.png

Figure 4.2: Results, multilingual corpus.

# Chapter 5

# Advanced features

## 5.1 Creating frequency tables

The normal search interface can be used to create many kinds of frequency tables, particularly if one takes care to set the 'max results' value appropriately. However, for efficiency reasons, very general frequency lists cannot be created. Therefore, there is a separate interface for creating tables of word frequencies from entire corpora (figure 5.1). This page can be reached by the 'statistics' link in the main window.

The user can specify what to include in the table (this should be familiar from section 3): word form, lemma form, part-of-speech label, or a combination of theese.[1]

There are several kinds of restrictions that the user can put on the compilation:

- POS filter: Only include words of a particular part-of-speech

- Cutoff: Only include this number of words (i.e. the 1000 most frequent words)

- Meta-data: A subcorpus can be created according to meta-data restrictions. This is done in the same way as described in section 2.4.

If there are meta-data restrictions, the compilation will include a *contrastive frequency* count; the table will also, by default, be sorted by decreasing frequency contrast. This means, essentially, that the expected frequency of each word (computed from the rest of the corpus) is contrasted with the actual frequency in the selected subcorpus.

In the example in figure 5.2, Norwegian texts with the topic «health» has been selected. The first word, «pasient» ('patient') occurs 1237 times in those texts; it occurs 1661 times in the entire corpus, and thus we would expect it to occur 7664 times (this depends on the total number of tokens in the corpus). Thus the frequency contrast is 6003. Other words with high frequency contrast is «legemiddel» ('medication'), «sykehus» ('hospital'), «apotek» ('pharmacy') etc.

---

[1] These choises are ignored when meta-data restrictions are selected: That will always give lemma and part-of-speech label.
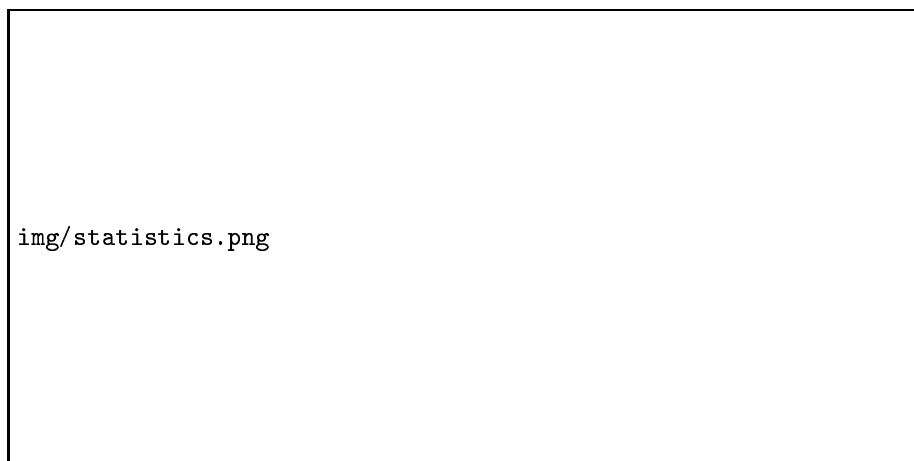
img/statistics.png

Figure 5.1: Interface for frequency tables.
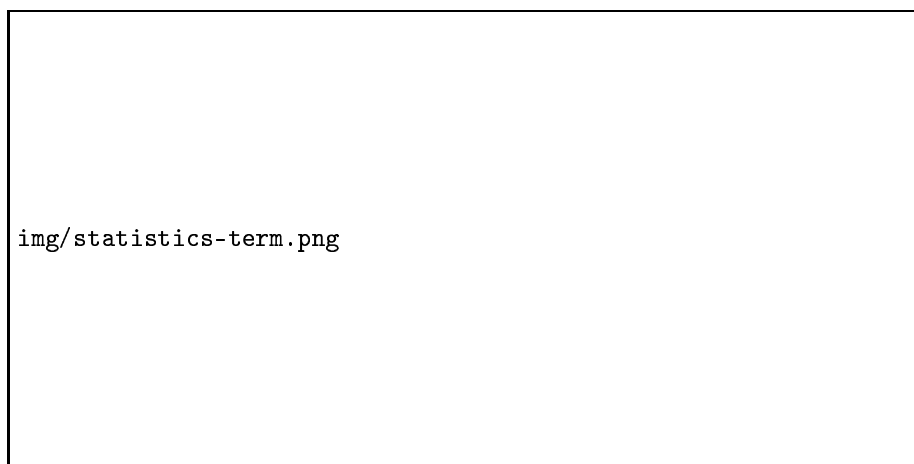
img/statistics-term.png

Figure 5.2: Frequency contrasts for health-related Norwegian texts.

Note that all frequency compilations can take up to several minutes, depending on the size of the corpus.

## 5.2 Fullquery mode

As mentioned in the introduction, Glossa does not give complete flexibility. Therefore, a separate interface is provided, allowing the user to input CQP queries directly. This page can be reached by the 'statistics' link in the main window.

The CQP query language is documented here:

- The CQP Language Tutorial, chapter 2.4 – 2.8:

  - http://www.ims.uni-stuttgart.de/projekte/CorpusWorkbench/CQPTutorial/html/node11.html
  - http://www.ims.uni-stuttgart.de/projekte/CorpusWorkbench/CQPTutorial/html/node12.html
  - http://www.ims.uni-stuttgart.de/projekte/CorpusWorkbench/CQPTutorial/html/node13.html
  - http://www.ims.uni-stuttgart.de/projekte/CorpusWorkbench/CQPTutorial/html/node14.html

- The CQP User's Manual, chapters 3 and 4

  - http://www.ims.uni-stuttgart.de/projekte/CorpusWorkbench/CQPUserManual/HTML/node11.html#
  - http://www.ims.uni-stuttgart.de/projekte/CorpusWorkbench/CQPUserManual/HTML/node16.html#

# Appendix A

# Acknowledgements

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Other corpus interfaces that has provided inspiration are:

- CorpusEye, developed at The University of Southern Denmark (http://corp.hum.sdu.dk `http://corp.hum.sdu.dk`); designed by Eckhard Bick and by Poul Henriksen and Nikolaj Hald Nielsen.

- BNCweb, developed at Zurich University (http://homepage.mac.com/bncweb `http://homepage.mac.com/bncweb`), by Hans-Martin Lehmann, Sebastian Hoffmann and Peter Schneider

- Interfaces by Paul Meurer and Knut Hofland, at the Aksis Center, University of Bergen

# Appendix B

# Regular expressions

A full account of the regular expressions used by CWB can be found on the IMS website `http://www.ims.uni-stuttgart.de/projekte/CorpusWorkbench/CQPUserManual/HTML/`.

## B.1  Optionality

The period (".") represents any character. Thus `.ats` will match "cats", "mats", "bats" etc.

A list of alternative characters can be represented with square brackets: `[cm]ats` will match either "cats" or "mats".

A list of alternative strings can be represented with the vertical bar: `cats|mats` will again match either "cats" or "mats".

## B.2  Occurrences

The number of times characters can occur can be specified with the following operators:

? `cats?` matches both "cat" and "cats"

* `the*` matches "th", "the", "thee" etc.

+ `the+` matches "the", "thee", etc.

{n,n} `the{1,2}` matches "the" or "thee".

## B.3  Escaping operators

All the regular expression operators can be searched for; they are interpreted literally if they are prefixed by a backslash. Thus `\.` maches a period in the corpus, and `\?` matches a question mark.

# Appendix C

# CE licencing

## GNU GENERAL PUBLIC LICENSE

Version 2, June 1991

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