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
- Safari

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.

[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 box designated «word 1» 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

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

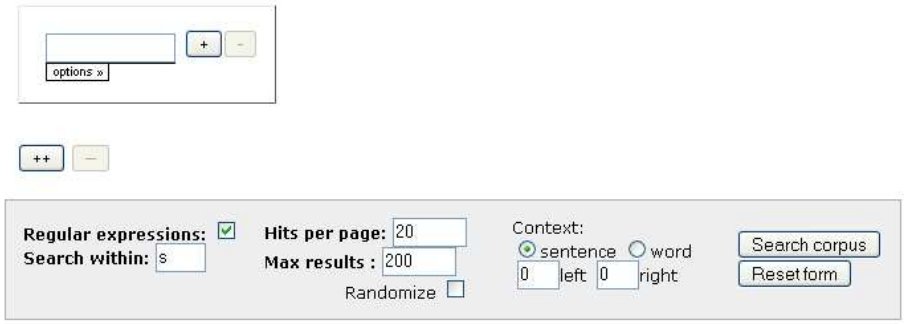


Figure 2.1: Simple interface.

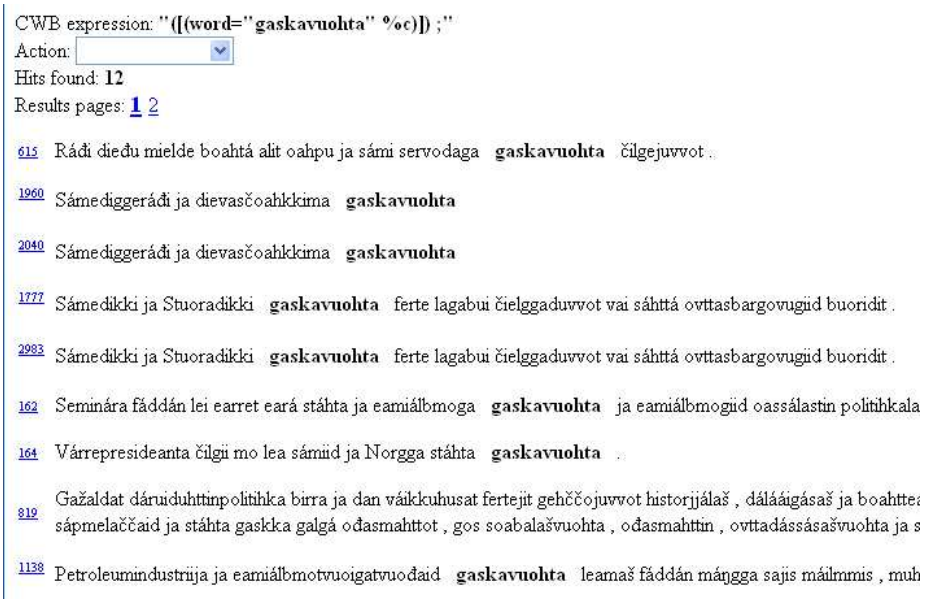


Figure 2.2: Results page.

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".

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.

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

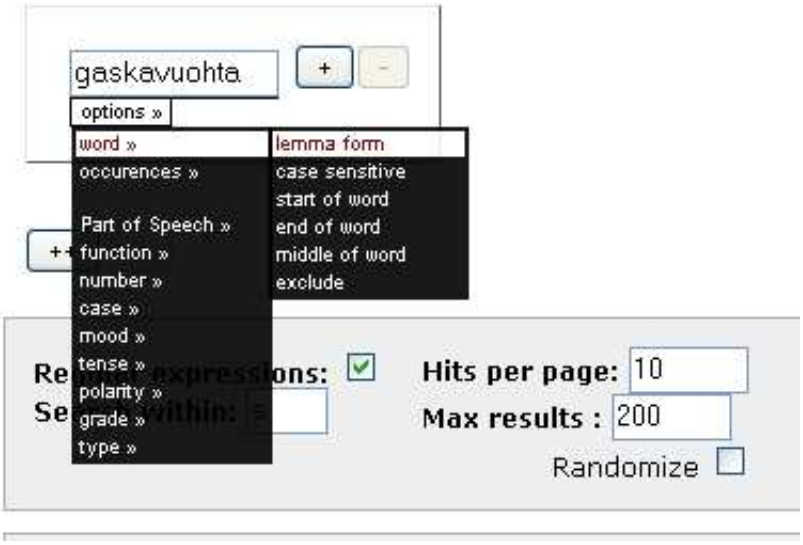


Figure 2.3: Selecting an option.

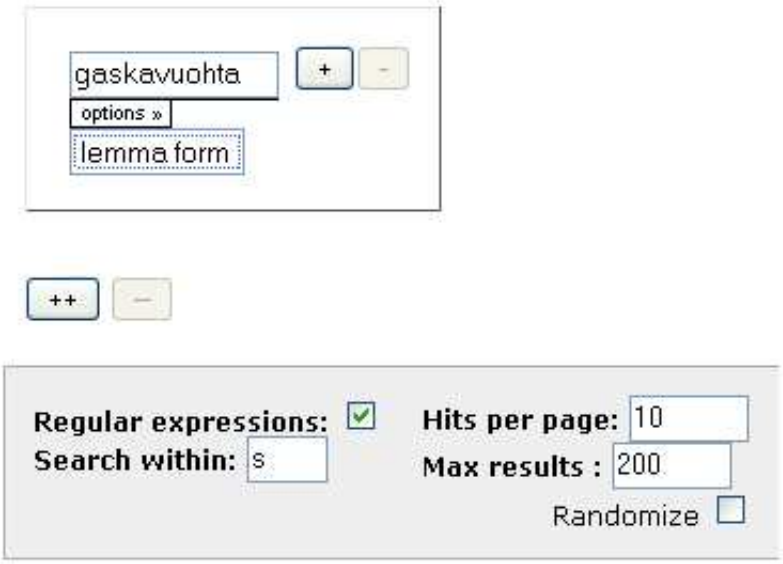


Figure 2.4: Selected option.

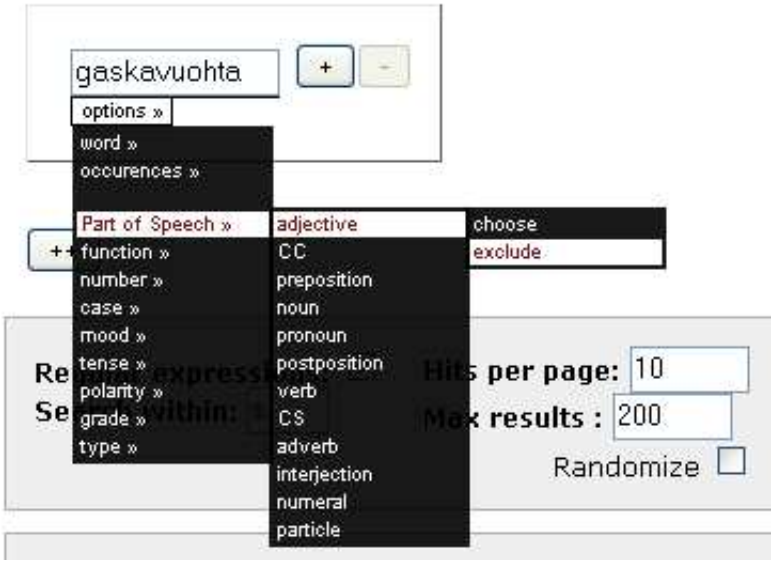


Figure 2.5: Selecting a negated option.

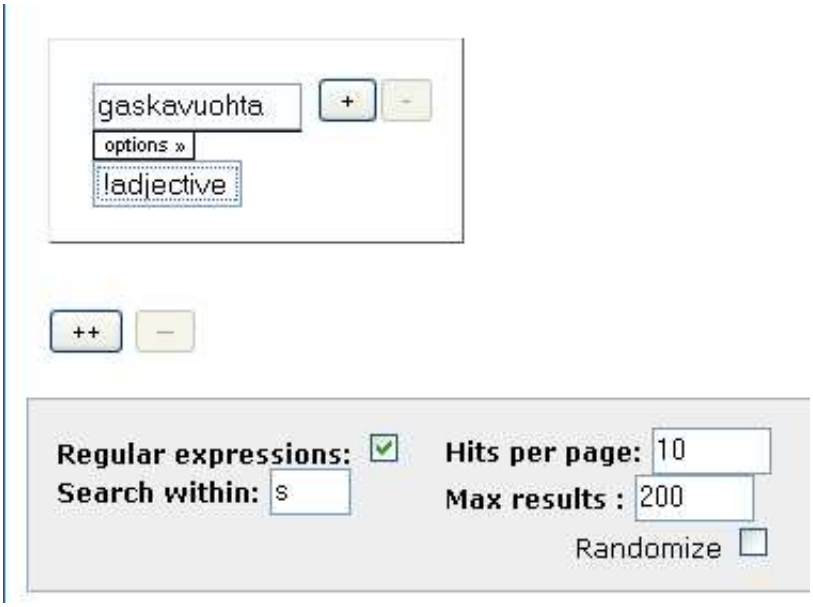


Figure 2.6: A negated option.

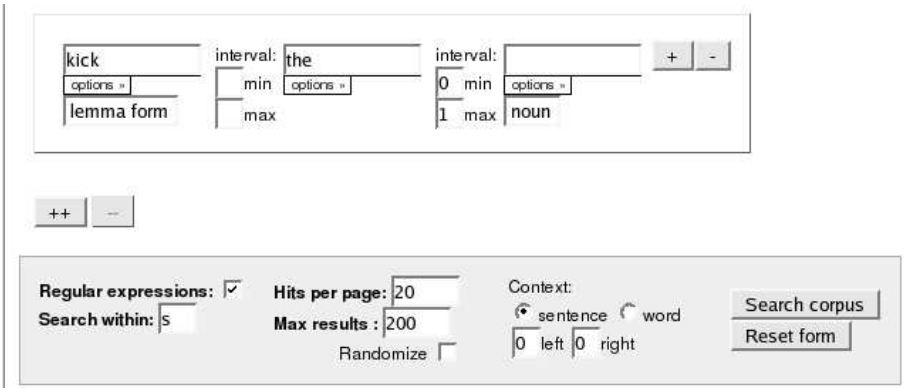


Figure 2.7: Phrase search.

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:

(2.3) 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.

2.2.1 Additional phrases

In some cases, it can be useful to join two different queries in the same result set. This can be done by adding additional phrases, with the buttion marked «++» (these can be removed by clicking the button marked «- -»).

For example, figure 2.8 demonstrates a search for both «coin museum» and «museum for coins».

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.

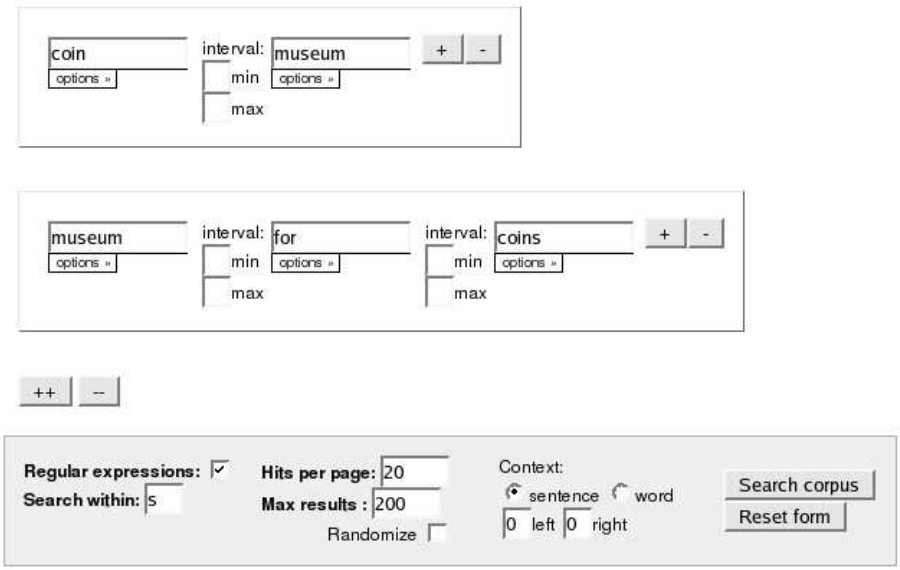


Figure 2.8: Several phrases.

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.

integer where all matches will be within the specified number of tokens

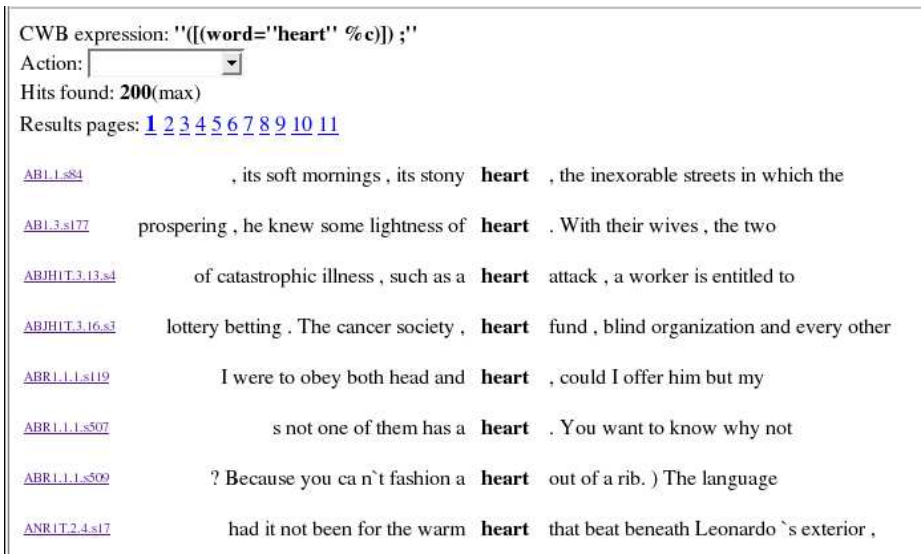
If you set the «search within» parameter to 's' and search for «kick» and «bucket» with an unlimited number of unspecified tokens in the phrase query, you will only get results where «kick» and «bucket» is in the same paragraph.

Results per page

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

Number of results

Searching for common words in large corpora can be slow. Restricting the total number of results can improve response times. Unless 'randomize' is selected, the first hits in the corpus will be displayed.


CWB expression: "([(word="heart" %c)]) ;"
Action:
Hits found: 200(max)
Results pages: 1 2 3 4 5 6 7 8 9 10 11

AB1.1.s84	, its soft mornings , its stony	heart	, the inexorable streets in which the
AB1.3.s177	prospering , he knew some lightness of	heart	. With their wives , the two
ABJH1T.3.13.s4	of catastrophic illness , such as a	heart	attack , a worker is entitled to
ABJH1T.3.16.s3	lottery betting . The cancer society ,	heart	fund , blind organization and every other
ABR1.1.1.s119	I were to obey both head and	heart	, could I offer him but my
ABR1.1.1.s507	s not one of them has a	heart	. You want to know why not
ABR1.1.1.s509	? Because you ca n`t fashion a	heart	out of a rib.) The language
ANR1T.2.4.s17	had it not been for the warm	heart	that beat beneath Leonardo `s exterior ,

Figure 2.9: A KWIC concordance.

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 2.9 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 2.10. 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 2.10) and checkboxes («translation» in 2.10) should be straighforward. The tables are used as follows:

- items are moved from one column to the other eiter by double-clicking

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

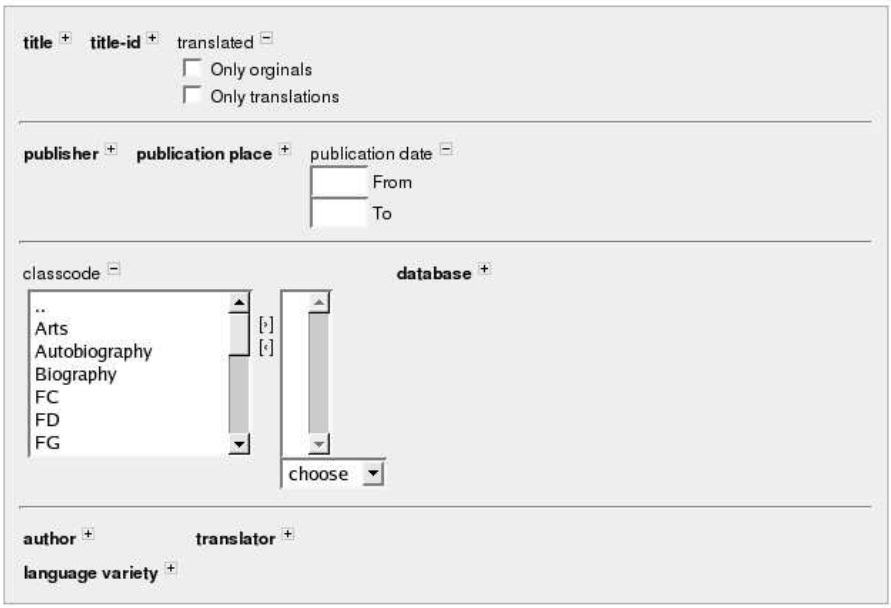


Figure 2.10: Meta-data restrictions.

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 2.11 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.

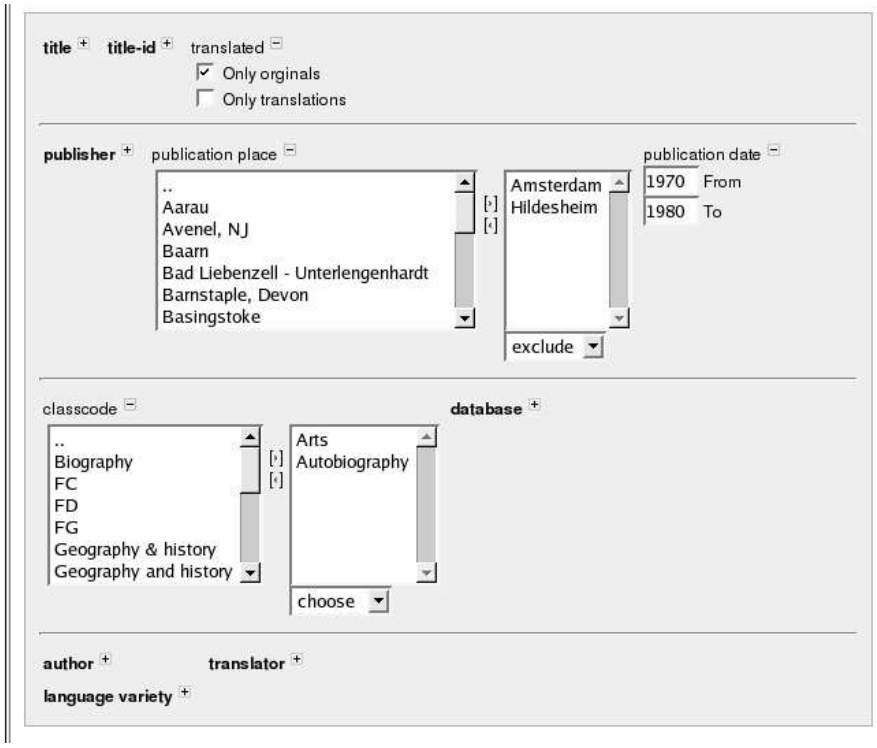


Figure 2.11: Restrictions on meta-data.

Chapter 3

Browsing results

3.1 The results pages

The results page consists of:

- The CWB search string
- A list of available actions for further processing of the result set (described in section 3.2).
- The number of matches returned.
- 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.

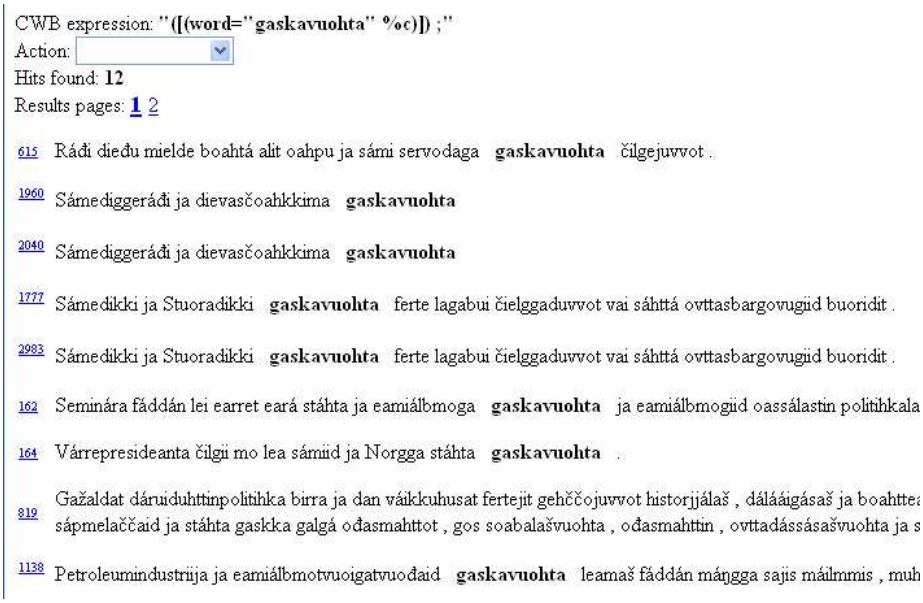


Figure 3.1: Results page.

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

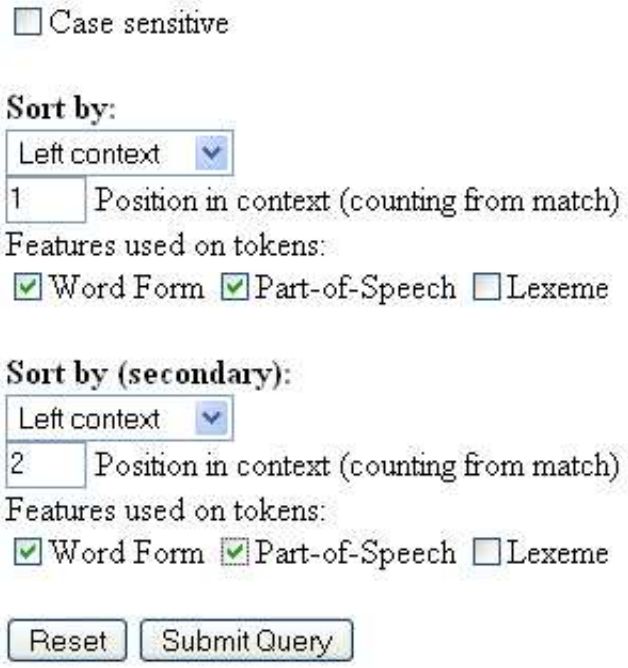


Figure 3.2: Sorting options.

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

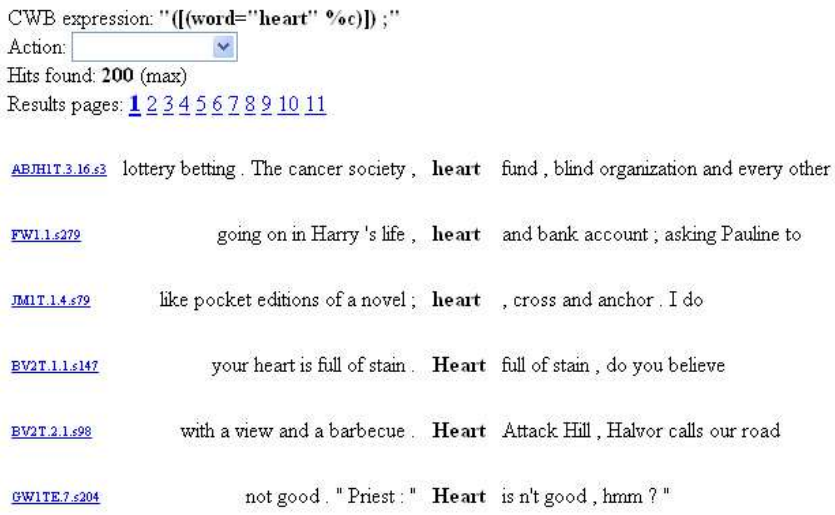


Figure 3.3: Sorted result set.

- 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.

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 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.

Chapter 4

Querying multilingual corpora

Exploring multilingual corpora with GLOSSA is very similar to exploring monolingual 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.

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]

[1] This is a result of limitations in CQP.

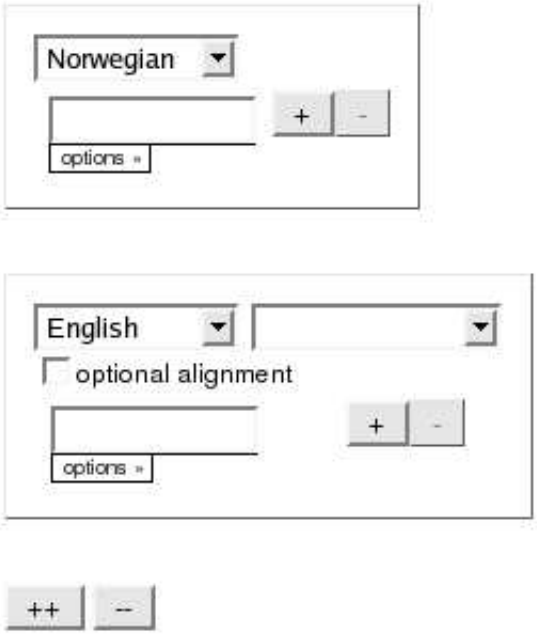


Figure 4.1: Multilingual search.

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).

[2]This is a result of limitations in CQP.

Figure 4.2: Results, multilingual corpus.

4.3 Processing results

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

4.4 Miscellanea

When searching for common words, it is recommended to use 'randomize', since it will generally be faster.

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.

Chapter 5

Querying speech corpora

Chapter 6

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 6.1).

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 6.2, 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.

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

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

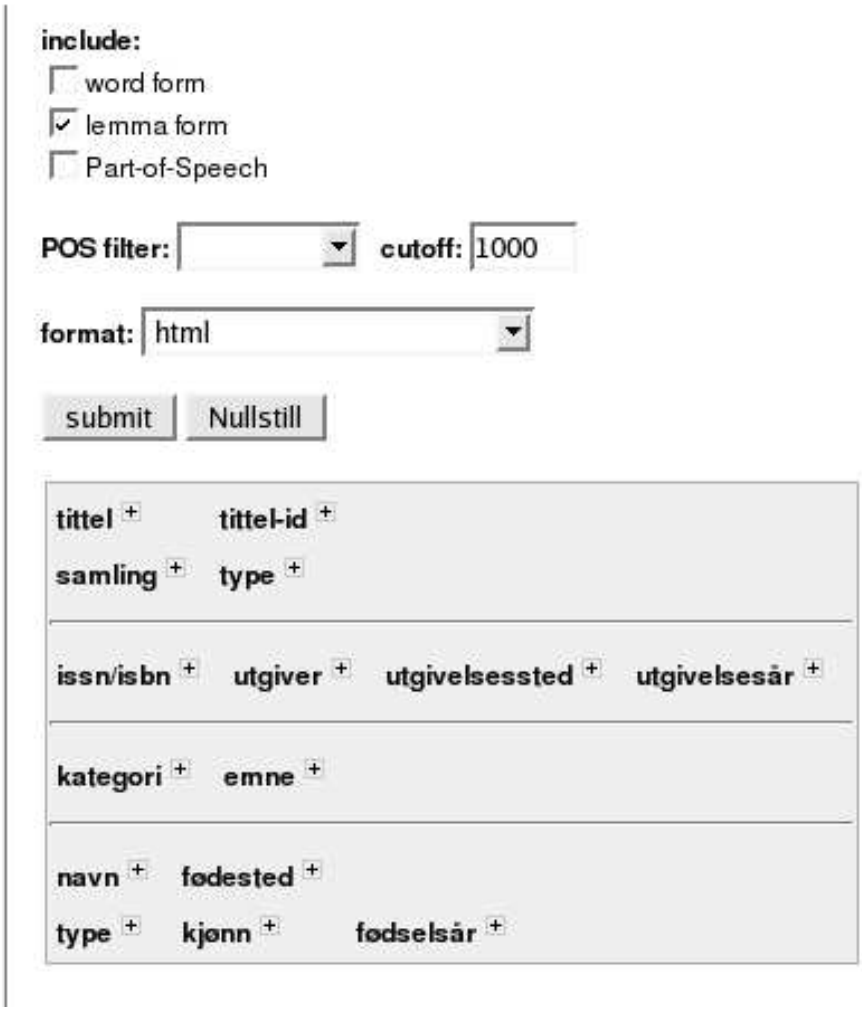


Figure 6.1: Interface for frequency tables.

#	word	freq	glob freq	expected	diff
1	pasient__s	1237	1661	7664	6003
2	legemiddel__s	869	43	5384	5341
3	sykehus__s	720	1272	4461	3189
4	apotek__s	503	13	3116	3103
5	behandling__s	836	2333	5179	2846
6	tuberkulose__s	466	119	2887	2768
7	lege__s	646	2118	4002	1884
8	regionsykehus__s	289	4	1790	1786
9	kreft__s	314	293	1945	1652
10	fylkeskommune__s	237	118	1468	1350
11	medisinsk__adj	290	735	1796	1061
12	grossist__s	153	19	947	928
13	preparat__s	150	31	929	898
14	helsetjeneste__s	156	128	966	838
15	tuberkulosekontroll__s	136	7	842	835

Figure 6.2: Frequency contrasts for health-related Norwegian texts.

Chapter 7

Querying treebanks

Appendix A

Acknowledgements

The development has been done at The Text Laboratory, University of Oslo; partially financed by the SPRIK project `http://www.hf.uio.no/forskningsprosjekter/sprik/`.

Several people have given valuable input to the development: Janne Bondi Johannessen, Kristin Hagen, Åshild Søfteland, Cathrine Fabricius Hansen, Stig Johansson, Hilde Hasselgård, Hans Petter Helland, Anders Nøklestad, Elisabeth Lien, Ruth Vatvedt Fjeld, Bergljot Behrens, Hilde C. F. Haug, Ingunn Indrebø Ims, Signe Laake, Inger Margrethe Seim, Torgrim Solstad, Wiebke Ramm.

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

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Version 2, June 1991

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