



NORTH-WEST UNIVERSITY  
YUNIBESITI YA BOKONE-BOPHIRIMA  
NOORDWES-UNIVERSITEIT



## GENERAL REPORT

**Final report on the Afrikaans wordnet project  
with tutorial on accessing and navigating the  
data**

**1.1.0**

**Gideon Kotzé**

## DOCUMENT INFORMATION

<b>Filename</b>	Report.AWN.FinalReportForDSTOnWordnetProject.1.1.0.UJ.2007-09-03.doc
<b>Type</b>	General Report
<b>Title</b>	Final report on the Afrikaans wordnet project with tutorial on accessing and navigating the data
<b>Version</b>	1.1.0
<b>Source Author(s)</b>	GJ Kotzé
<b>Commentator(s)</b>	S Pilon, U Janke
<b>Status</b>	Final Version
<b>Date</b>	2007/09/03
<b>Pages</b>	15
<b>Security Classification</b>	Only Distributors
<b>Distribution</b>	CText, Meraka, Department of Science and Technology
<b>Key Words</b>	AFRIKAANS WORDNET; FINAL REPORT; DEPARTMENT OF SCIENCE AND TECHNOLOGY; LEXICAL DATABASE; SYNSET
<b>Project</b>	Afrikaans wordnet

## DOCUMENT HISTORY

<b>Version</b>	<b>Date</b>	<b>Status</b>	<b>Author/Commentator</b>
Version of document when opened	Date of document as specified by previous author	Status of document when opened	Name of previous author(s) or commentator(s)
1.0.0	2007-08-30	Concept Version	Suléne Pilon
1.0.1	2007-08-31	Concept Version	Gideon Kotzé
1.0.2	2007-08-31	Concept Version	Suléne Pilon
1.0.3	2007-08-31	Concept Version	Gideon Kotzé
1.0.4	2007-08-31	Concept Version	Suléne Pilon
1.0.5	2007-08-31	Concept Version	Ulrike Janke
1.0.6	2007-08-31	Concept Version	Gideon Kotzé
1.0.7	2007-08-31	Concept Version	Suléne Pilon

# Contents

<b>1.</b>	<b>Summary.....</b>	<b>4</b>
<b>2.</b>	<b>Background .....</b>	<b>4</b>
<b>3.</b>	<b>Project plan.....</b>	<b>4</b>
3.1.	Communication with collaborators .....	5
3.2.	Resources.....	5
3.3.	Software.....	6
3.4.	Format and appearance of entries .....	6
3.5.	Selecting an ontology .....	7
3.6.	Finding additional resources and developing additional software .....	8
3.7.	Documentation of progress and issues.....	8
3.8.	Building the ontology using the words chosen as entries.....	8
3.9.	Providing all relevant information of all entries.....	8
3.10.	Making the relationships between words explicit .....	8
3.11.	Updating the software for the navigation of the relationship links .....	9
3.12.	Building of synsets.....	9
3.13.	Format of conceptualization and list of concepts .....	9
3.14.	Testing the database .....	9
3.15.	Documentation of progress and issues in the form of scholarly articles. ....	10
<b>4.</b>	<b>Conclusion.....</b>	<b>10</b>
<b>5.</b>	<b>Tutorial.....</b>	<b>11</b>
5.1.	Accessing the database.....	11
5.2.	Navigating the database .....	13
5.3.	The semantic relations.....	15

## 1. Summary

This document is a report about the Afrikaans wordnet project, sponsored by the Department of Science and Technology. A brief summary on the project background is given in Section 2 after which Section 3 provides more information on the phases the project underwent during the development stage. The document concludes with a tutorial in Section 4, where the steps necessary to access and navigate the database are described.

## 2. Background

The development of an Afrikaans wordnet was made possible by a grant of R138 000 from the Department of Science and Technology. The project period was set from 1 September 2006 up to and including 31 August 2007. Preliminary research was done in the form of a Master's thesis by Mr Gideon Kotzé at the Free University in Amsterdam, The Netherlands. The project documented here involved the building of an electronic lexical database consisting of 5 000 sets of synonyms (synsets) that are connected to the Princeton WordNet. At the time this document was distributed, the lexical database (or wordnet) contained 5043 synsets.

## 3. Project plan

The original chronological project plan for the project follows in Table 1 below.

Period	Contents
September – December 2006	<ul style="list-style-type: none"><li>• Communicate with collaborators. The main collaborator is Prof Piek Vossen from the Free University in Amsterdam, The Netherlands. His primary role is that of an advisor.</li><li>• Decide which resources are going to be used and how.</li><li>• Decide which software is going to be used for the development process.</li><li>• Decide on the format and appearance of entries.</li><li>• Choose an ontology.</li><li>• If necessary, find any additional resources and develop additional software for the development process.</li><li>• Develop a small prototype of 100 entries.</li><li>• Document progress and any issues in the form of technical reports.</li></ul>
January – August 2007	<ul style="list-style-type: none"><li>• Build the ontology using all the words chosen as entries.</li><li>• Provide all relevant information of all entries, such as definitions, word classes, example sentences, etc.</li><li>• Make all relationships between all words explicit, for example</li></ul>

	<p>synonyms and hyponyms.</p> <ul style="list-style-type: none"> <li>• Update the software to enable them to navigate these relationship links.</li> <li>• Build so-called “synsets”, groups of words related to each other that can be used interchangeably to point to the same concept. The total number of synsets will be 5 000.</li> <li>• Decide on the chosen format of conceptualization and build a list of concepts.</li> <li>• Test the growing database.</li> <li>• Document progress and any issues in the form of technical reports and scholarly articles.</li> </ul>
--	---

**Table 1: Original Project Plan**

Each of the “Contents” in Table 1 will be briefly discussed below.

### 3.1. Communication with collaborators

On 19 and 20 March 2007, our main collaborator, Prof Piek Vossen, visited CText. He was the first reader of Mr Kotzé’s thesis which formed part of the preliminary research process. His previous experience with other wordnets has been very helpful in our discussions about our project. During his visit, he gave a lecture on a related topic, *viz.* the Global Wordnet Grid, and another one on the design of *Cornetto*, a unique lexical database for Dutch.

The team at the NLPlab in Masaryk University, Brno, Czech Republic, who provided the software programme *DEBVisDic*, has also been of great help throughout the project period.

### 3.2. Resources

After the preliminary research, we decided to select a set of 4 689 English synsets from the Princeton WordNet (version 2.0) which was available as part of a software program, *VisDic*, designed for viewing and editing wordnets. These synsets were used as starting concepts in a European multilingual wordnet database, EuroWordNet, and were also later used in a similar project, *BalkaNet*, where they were categorised in so-called *BalkaNet Common Sets*. The chosen synsets were then translated into Afrikaans.

For the translation process, the *Groot Woordeboek/Major Dictionary*<sup>1</sup> was chosen as a bilingual source. Other official sources used for assistance in translation and evaluation of synsets were the electronic version of the *Groot Tesourus van Afrikaans*<sup>2</sup> and the Afrikaans *Puk/Protea* corpus.

<sup>1</sup> [Groot Woordeboek : Afrikaans-Engels, Engels-Afrikaans / \[Vroeëre Samestellers, M.S.B. Kritzinger, P.C. Schoonees En U.J. Cronjé\].](#) Eksteen, Louis Cornelius. Kaapstad : Pharos, 1997.

<sup>2</sup> [Tesourus Van Afrikaans / L.G. De Stadler. Met Die Medewerking Van Amanda De Stadler.](#) De Stadler, L. G. (Leon G.) Kaapstad : Pharos, c2007.

The whole of the Princeton WordNet, containing 117659 synsets<sup>3</sup>, is available for free and was the most important resource used in the development of the Afrikaans wordnet.

### 3.3. Software

The software that we planned to use for the construction of the wordnet is a database program called *DEBVisDic*. It was developed by the NLPlab at the Masaryk University in Brno, Czech Republic. For the automatic manipulation of data, scripts needed to be written in a programming language. The programming language of our choice was *Perl*.

Because of the fact that we were, until only a few months ago, negotiating a contract for the use of *DEBVisDic*, we had to use another programme, *VisDic*, which was developed by the same team in Brno. It is less powerful, but it proved sufficient on a temporary basis. The data edited in *VisDic* were eventually imported into *DEBVisDic* as originally planned.

The licence agreement to use the *Groot Woordeboek* was also only recently finalised and as a result, no automatic translation techniques were used and synsets were translated manually. The application of automatic synset translation methods is, however, a possibility since it is now possible to use the data of the *Groot Woordeboek*. The database program *Microsoft Access* was used as a temporary repository for our data and functioned as an environment where the synsets, which were extracted from the WordNet XML, were translated into Afrikaans. The translated synsets were then converted into the correct XML format for import into *DEBVisDic*, together with relevant additional information such as IDs and domain categories.

### 3.4. Format and appearance of entries

*DEBVisDic* can be used to display both the Princeton WordNet entries and the Afrikaans wordnet entries. As a result, the format and appearance of the Afrikaans entries are virtually identical to those of their English equivalents in the interface as well as in the XML structure. It is, however, possible to configure the program so that entries are displayed differently. For example, additional drop-down menus or text boxes can be added for editing purposes, or one can choose not to display a specific element such as example sentences. Because every Afrikaans synset has an equivalent in the English WordNet, the synsets in the different languages can be compared easily.

After construction, every synset contains the following information:

- Unique ID number
- Part of speech (“n” (for “noun”), “v” (for “verb”) or “a” (for adjective))
- Literals (a linguistic unit consisting of either a word, phrase or paraphrase and visually represented in *DEBVisDic* as a string of text between commas) and sense numbers

---

<sup>3</sup> According to their official web site (WordNet 2.0©. Princeton University. <http://wordnet.princeton.edu/>)

(eg. “eenwording”, sense 2, “vereniging”, sense 9 (corresponding to “union” sense 4 and “unification” sense 2 in the Princeton WordNet)

- Definition
- BalkaNet Concept Set (either 1, 2, 3 or none)
- A string, “false” if the concept is lexicalised (has a proper word or phrase in the language) and “true” if the concept is not lexicalised.
- A list of relations, displaying the nature of the relation (eg. “hypernym”) and the IDs of the synset or synsets to which the current synset is linked.
- A domain label where applicable, e.g. “Economy”.
- A *SUMO* (“Suggested Upper Merged Ontology” – for more information, see section 4.5 below) label, such as “Process”, with an accompanying symbol, which can be one of the following:
  - = : The WordNet synset is equivalent in meaning to the ontological concept.
  - + : The WordNet synset is subsumed by the ontological concept.
  - @ : The WordNet synset is an instance of the ontological concept.

### 3.5. Selecting an ontology

The Princeton WordNet is mapped to a formal ontology, the SUMO (Suggested Upper Merged Ontology), which was designed for the semantic web<sup>4</sup>. The Afrikaans wordnet is automatically mapped to this ontology since the structure from the Princeton WordNet is taken over. Moreover, many synsets are assigned a domain category, such as “Economy”, “Geology” or “Play”, which further helps to classify specific concepts. A synset’s relation to other synsets, and the nature of the relations, also result in a unique position for that concept in the network, which further reduces any possible ambiguity that can be a complicating factor in any kind of word sense disambiguation process. This means that the chances that one synset can be confused with another one are drastically reduced since they connect with other synsets and therefore their implicit meanings are differentiated. For example, the difference between the act of “combination” (“the act of combining things to form a new whole”) and “combination” in the sense of something that was combined (“a collection of things that have been combined; an assemblage of separate parts or qualities”) can easily be established by taking their hypernyms (a “type of” relationship) into account. The first “combination” can be seen as a type of “activity”, while the second “combination” can be seen as a type of “group”.

---

<sup>4</sup> Pease, A., Niles, I., and Li, J. 2002. [The Suggested Upper Merged Ontology: A Large Ontology for the Semantic Web and its Applications](#). In *Working Notes of the AAAI-2002 Workshop on Ontologies and the Semantic Web*, Edmonton, Canada, July 28-August 1, 2002.

### 3.6. Finding additional resources and developing additional software

It was not necessary to obtain additional software.

Regarding resources, we made use of a variety of other dictionaries as reference material to obtain our definitions.

### 3.7. Documentation of progress and issues

The body of official documents on the project comprises the following:

- The progress report written for the project demonstration in March 2007.  
("Report.AWN.ProgressReportForDST.1.0.0.GJK.2007-03-29.doc")
- The tutorial accompanying the progress report, included in the same file.
- The final report on the wordnet project.  
("Report.AWN.FinalReportForDSTOnWordnetProject.1.0.0.GJK.2007-08-31.doc")
- The tutorial accompanying the final report, included in the same file.

### 3.8. Building the ontology using the words chosen as entries

As the ontology we were going to use had already been developed, the main task was to translate English synsets into Afrikaans and taking over the existing structure of the Princeton WordNet. Princeton WordNet data (in XML format) was imported from *VisDic* to *Microsoft Access* (where the synsets were translated) via a *Perl* script. After the synsets were translated, another *Perl* script was used to transform the data back into XML format. It was then imported into *DEBVisDic* to enable further manual editing and refinement. At this stage the data included the semantic relations from the Princeton WordNet between the synsets, as well as the domain category, the *SUMO* label and the *BalkaNet Concept Set* category number for each synset.

### 3.9. Providing all relevant information of all entries

Since the *SUMO* and category domain labels were already present in the data, only the definitions and example sentences remained to be included. Because of the fact that we are still negotiating to obtain a large Afrikaans corpus, we were unable to generate example sentences. The generated definitions were then added to the main database using a *Perl* script.

### 3.10. Making the relationships between words explicit

Except for synonyms, all the relationships in the database are semantic relations, i.e. they exist between synsets (i.e. concepts) and not between words. These relationships are not language specific and can therefore be imported from the Princeton WordNet as is. An

example would be the synset “body part” which is a kind of “part” or “piece” (hyponymic relation) where in Afrikaans the equivalent would be “liggaamsdeel” which is a kind of “gedeelte”, “stuk” or “deel”. The only relation that is not imported from the Princeton WordNet is the English derivative relation that exists, for example, between “communication” and “communicate”. This relation is not always equivalent in Afrikaans.

Since concepts are expressed differently in different languages, synset equivalent relations between English and Afrikaans are not always one-to-one. Sometimes, an equivalent is not present in the one language (such as in Afrikaans for the English word “unerec”), sometimes it can only be expressed **more generally** (such as in the Afrikaans “motorfiets”) for the English word “minibike, motorbike”), sometimes it can only be expressed **more specifically** (such as in Afrikaans for the English word “cousin”, where there are only words for either the male or female variant) and sometimes a **fine distinction** between concepts in one language are not made in another (such as “conveyance, transport” and “vehicle” which are in Afrikaans only translated as “voertuig, vervoermiddel”). In *DEBVisDic*, the database was edited so that these distinctions are indicated.

### 3.11. Updating the software for the navigation of the relationship links

As was mentioned in section 3.4., the current software already has the ability to navigate synsets via their established semantic relations.

### 3.12. Building of synsets

Synsets were built by translating English synsets into Afrikaans, as was mentioned in section 3.3. Each synset points to a specific concept, regardless of language, and therefore the Afrikaans wordnet has the same underlying data structure as its English equivalent.

### 3.13. Format of conceptualization and list of concepts

A list of concepts represented by synonym sets can be accessed easily in the software used to edit and browse the wordnet (*DEBVisDic*). The list of concepts is also available in the form of tables in *Microsoft Access* database files. They can also be exported to other file formats, such as spreadsheets or text files.

### 3.14. Testing the database

The database and all related processes were tested continually during the development of the Afrikaans wordnet. For example, the process of exporting and converting translated synsets from *Microsoft Access* to the correct XML format and importing it to *VisDic* and eventually *DEBVisDic* for correct display has been tested thoroughly. We have also

tested various aspects of *DEBVisDic*, including importing data, editing data, navigating synsets and looking up equivalents of synsets in the other wordnet.

### 3.15. Documentation of progress and issues in the form of scholarly articles.

Two conference papers on the Afrikaans wordnet were presented. They are:

- *Ontwikkeling van 'n Afrikaanse woordnet: metodologie en integrasie* (Development of an Afrikaans wordnet: methodology and integration) at *LSSA/SAALA/SAALT 2007* in Potchefstroom from 4-6 July 2007
- *Development of an Afrikaans wordnet: methodology and integration* at *ALASC007* in Port Elizabeth from 9-11 July 2007.

At least one further article is to be submitted on the 30<sup>th</sup> of September 2007 for publication in the *Literator* magazine.

## 4. Conclusion

We would once more like to thank the Department of Science and Technology for providing the funds necessary to complete this project. The Afrikaans wordnet is on its way to becoming a useful linguistic resource which can be applied in a variety of ways, some of which are listed below.

- It functions as a lexicographic resource where meaning is very explicitly defined in terms of synonyms, semantic relations, definitions, domain labels and *SUMO* labels.
- Meaning can be explicitly compared to equivalents in other languages such as English. If wordnets in other languages are added to the same database repository, the same applies to those languages.
- Lexicographic resources such as dictionaries can be derived from the wordnet.
- The wordnet can be used as a resource or combined with other resources to form applications in semantic processing. Examples include information extraction and automatic document summarisation.

If the wordnet can be applied in automatic semantic processing applications, it is not only a very useful linguistic resource, but it can be used as a tool to effectively manage data and obtain information that can, for example, be used to run a business more effectively. Expanding the wordnet will also facilitate general linguistic as well as cross-linguistic research and the production of multilingual lexicographic resources.

## 5. Tutorial

### 5.1. Accessing the database

If there are any installation difficulties that are not covered by the following instructions, an email can be sent in English to the developers at [deb@aurora.fi.muni.cz](mailto:deb@aurora.fi.muni.cz). These are the required steps for installation:

- One can select to either host the database itself on a server or to install a client on a computer that can access the database on a remote computer. Since we are not hosting the database for general access on the internet, it would be necessary to obtain the full version of *DEBVisDic* for local hosting. The program was written for a network environment, but both the server and client can be on the same computer. The following would be needed:
  - For the server side, one needs a computer with the Linux Ubuntu 6.06 Dapper operating system with an active internet connection.
  - For the client side, the computer must have *Mozilla Firefox* installed on it. The latter is available free of charge at <http://www.mozilla.com/en-US/firefox/> and can be installed on any system that supports it, which includes *Microsoft Windows* and the *Linux* operating systems.
- The main page for installation procedures is <http://nlp.fi.muni.cz/projekty/deb2/>. The server packages need to be installed first. They can be found on <http://nlp.fi.muni.cz/projekty/deb2/apt/>. More specifically, the packages to be installed are “debserver-common” and “debserver-wordnet”.
  - Edit APT’s config and add the Universe repository.
  - Add DEBVisDic’s repository to APT.
  - Add the ‘deb’ user to the ‘debsvr’ group.
  - Go to `/var/lib/deb-server/cert` and read the README on how to create the certificates.
- Importing the XML data: We will send the data on request in order for this to be achieved. This entails the following steps:
  - Verify the XML files are utf8.
  - Go to `../bin` and follow the instructions on how to import the dictionaries (see below).
  - Go to `../db` and verify that the owner is `deb:debsvr` and the permissions is `ug+rw`.
  - Start the server.
- Importing:
  - Open the console and go to the directory `/var/lib/deb-server/bin`

- Then run: `./index_wn.rb -db-file=wnafr.dbxml -code=wnafr --\ name="Afrikaans WN" -source-xml=/path/to/xml/file`.<sup>5</sup>
- The Princeton WordNet must be imported in the same way. The required version is 2.0, which is downloadable from <http://nlp.fi.muni.cz/projekty/visdic/>. The name of the file is [wneng20c.zip](#). Because of its size, importing this can take several hours, depending on the speed of the computer. The command line to be used here is: `./index_wn.rb -db-file=wneng.dbxml -code=wneng --\ name="English WN" -source-xml=/path/to/xml/file`
- The service set-up includes the following steps:
  - In the browser on the server computer, open the following address in the browser: `https://hostname:8000`<sup>6</sup>
  - The default login is “deb” and the password is also “deb”. To change it, click on “change my password”.
  - Go to “services”.
  - Then create a new service:
    - code: `debvisdic`
    - name: `DEBVisDic`
    - Check the box next to `wnafr`.
    - Click on “save”.
- The next step is setting up the users:
  - Click on “users”.
  - Click on a user name to edit the user or fill in the form at the bottom of the page to add new users.
  - Check the box next to “debvisdic” and write “w” to the box next to “wnafr”.
- Next, the service must be started:
  - Open the console and run (as root or using sudo):
    - `/etc/init.d/debserver-common restart wordnet_services`
  - The log file is in `/var/log/deb-server/wordnet_services.log`
- To be able to navigate the wordnets simultaneously, one must specify a look-up dictionary for each wordnet. On the admin page, click on “dictionaries” and fill in the “lookup” fields: For “wnafr”, fill in “wneng1” under “lookup dictionary” and under “wneng”, fill in “wnafr1” for the lookup dictionary.
- The next step is to download and install the client software at <http://nlp.fi.muni.cz/projects/deb2/clients/>. Instructions can be found at <http://nlp.fi.muni.cz/trac/deb2/wiki/DebVisDicManual/>.

---

<sup>5</sup> Please note that the \ at the end of the first line should not actually be in the command, but is merely an indication that the next line follows directly after the first one without a line break.

<sup>6</sup> In the place of “hostname”, one should type in the domain name of the machine on which *DEBVisDic* is being installed.

- After installation, one must first fill out a declaration form (<http://nlp.fi.muni.cz/projekty/deb2/debdict/>) before one can receive a user name and password. Under the field “What you will use”, type in “DEBVisDic”.
- If all goes well, the user should receive his or her user name and password within a few days.
- Before opening the client, the user must restart Mozilla Firefox.
- Click on “Tools” and then “DEBVisDic”.
- The client will then try to connect to the developers’ server, since this is the default setting. Therefore, cancel the login dialog.
- In the DEBVisDic main window, select Settings and then Connection settings.
- As a server address use “https://hostname:9001/”.
- Click on OK and a login dialog should open asking for your password.
- Next time DEBVisDic is run, your server address will be used.

## 5.2. Navigating the database

Once a connection is made, the user can access both the Afrikaans and the English WordNet from the client. To open the wordnet for viewing, the following must be done:

- Double-click on the *Mozilla Firefox* icon, where the user has changed the argument parameters under *Properties* as is described in the installation instructions on <http://nlp.fi.muni.cz/projekty/deb2/debdict/>.
- *DEBVisDic* should open up and after a few seconds, should ask for a username and password. Type in the username and password received from the developers to obtain access.
- The program then automatically searches for any recent updates on the server. If the connection is correctly established, these updates will be made immediately.
- After this is done, click on *Settings* in the *DEBVisDic* window. Then click on *Preferences*. A list of all available dictionaries should be visible in the top left-hand window.
- Scroll down and select *Afrikaans WN*. Click on the *Add* button. Do the same with *English WN*.
- Other preferences, such as colours and spacing, can be set in this window.
- Click on *OK* in the bottom right-hand corner.
- The program then searches for updates again.
- For each wordnet selected, a window opens.
- Select the window for the Afrikaans wordnet (*Afrikaans WN*).

- There should be two windows visible in the current window. Between them, a tab with options is displayed.
- Click on the *Query* tab.
- Click on the text box at the top of the top window. Type in: SYNSET.ID=ENG.\*. This displays a list of all the synsets in the database that are directly linked to English synsets.
- Click on one of the synsets, eg. “[n] aanraking:1, kontak:1”. The numbers that are displayed after each word are sense numbers. For example, if “aanraking” occurs in another synset as well, the number will be different in that case. Then click on the tab, *Preview*, to view the contents, which are displayed in the bottom window. At the bottom, a list of all synsets is displayed to which the current synset is linked via a semantic relation. The direction and the type of the relation are displayed, followed by the relevant synset. For example: “-->> [hypernym] wisselwerking:1, interaksie:1” means that “wisselwerking:1, interaksie:1” is a hypernym of the current synset, “aanraking:1, kontak:1”.
- For this kind of relation (hypernym/hyponym) a tree can be viewed by clicking on the *Tree* tab. This displays all connected hypernyms up to the top of the tree. If there is a little plus sign on the left of a synset in the tree, one can click on it to expand the tree towards the bottom. Clicking on the tab *Revtree* reverses the process: It displays connected hyponyms up to the bottom of the tree, displaying the bottom nodes at the top. Clicking on a node in a tree and then clicking on the *Preview* tab display the information for that node.
- The XML data can be viewed by clicking on the *XML* tab.
- To view the English equivalent of the current synset, one can choose from one of three options:
  - Click on the *Preview* tab. Then right-click on any part in the bottom window. In the menu that pops up, choose *Show in* and select *English WN/1*. To automatically look up the English equivalents of an Afrikaans synset, choose *AutoLookUp in* and select *English WN/1*. Do the same to uncheck this option and enable manual lookup again. To view the English contents, choose the English WordNet window and browse the information precisely as with the Afrikaans wordnet. An Afrikaans synset, if it exists, can also be viewed as an equivalent of an English synset by repeating the process in the English WordNet window.
  - Right-click on any synset in a tree. Follow the same steps as in the first option.

- Click on the *XML* tab and right-click on any part in the bottom window. Then follow the same steps as in the first option.

### 5.3. The semantic relations

Following is an explanation of the semantic relation types:

- *Hypernym*: A more general concept, such as “vehicle” in relation to “car”.
- *Hyponym*: A more specific concept, such as “car” in relation to “vehicle”.
- *Meronym*: A part-of relation, such as “lock” in relation to “door”.
- *Holonym*: The inverse of a part-of relation, such as “door” in relation to “lock”. Holonyms and meronyms are divided into three categories: “part”, “member” and “portion”. The “part” category indicates a part-of relation only, such as “door” and “lock”. The “member” category indicates a member relation only, such as “herd” and “sheep”. The “portion” category indicates a portion relationship, where the portion is not something separate from the whole, such as “belting” and “belt”, or “oxtail” and “oxtail soup”.
- *Category domain* (inverse: *Category member*): A category relation, such as “rally, exchange” in relation to “tennis”.
- *Subevent*: A verbal relation indicating an event that the current one forms part of, such as “snore” in relation to “sleep”.
- *Similar to*: Indicates a synset that is similar to the current one but cannot be regarded as synonymous, such as “little, small” in relation with “young, immature”.
- *Also see*: Indicates a synset that has a related meaning but cannot be regarded as similar, such as “bodied” in relation with “corporeal, material”.
- *Near antonym*: Indicates a synset that can be regarded as having or nearly having the inverse meaning of the current one, such as “powerful” in relation with “powerless, weak”.
- *Verb group*: Indicates a verbal synset with a similar verbal sense, such as “breathe” in relation with “respire”. The difference with “similar to” is that the former forms part of a grouping of similar verb senses.
- *Causes*: Indicates a causal relation where the event or state described by the current synset causes the event or state described by the synset to which it is linked via this relation. Eg. “affect, impress, move, strike” in relation with “feel, experience”.
- *Be in state*: Indicates a relation where the one synset describes a state and the other a value of the state, such as “outwardness” in relation with “outward”, or “disposition, temperament” in relation with “willing” or “unwilling”.