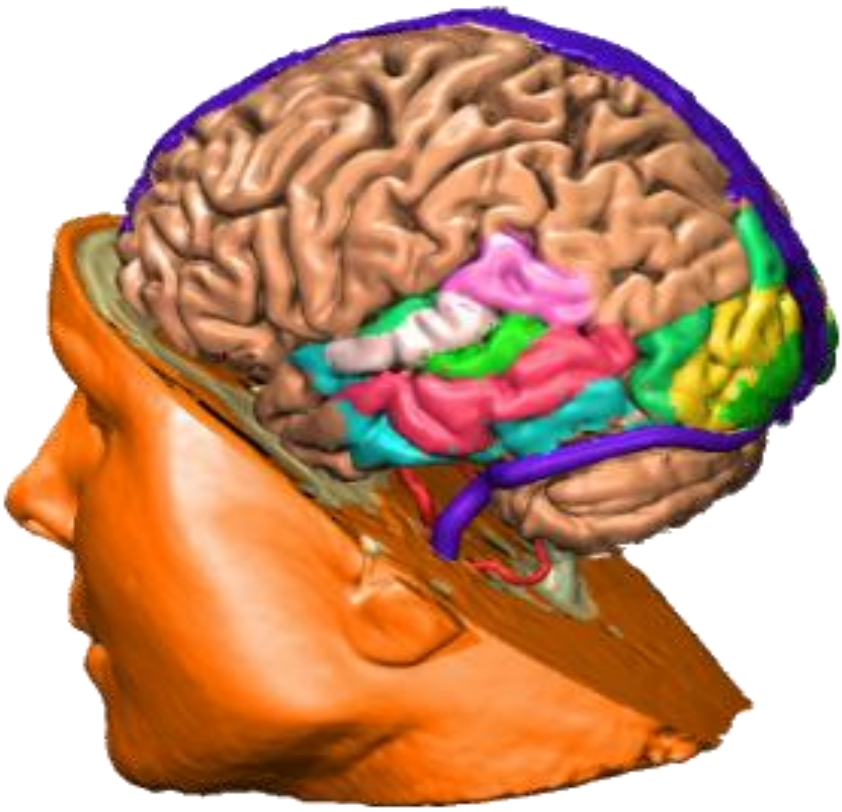
# DESIGN AND DEVELOPMENT OF MERRYTS

A TOOL FOR VISUALIZATION OF MEDICAL TERMINOLOGY SYSTEMS



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# Design and development of MERRYts:

A tool for visualization of Medical Terminology Systems

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January-May 2011

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# ABSTRACT

Structuring information in EHR[1] systems is essential to enable communication between various HISs and between the users of these systems. Data values captured in EHR systems can be structured and coded by using TSs.

When recording patient information, the medical professional needs to be supported in matching the concept he has in mind with a concept in the TS. There has been little evidence on the best way to provide this support.

A literature search resulted in some articles with basic advice for web based search-improvement, but no hard conclusions on the best way of presenting large collections of information could be drawn. Based on the literature requirements are defined for a tool that enables investigation of different ways of visualization of TS content. This paper describes the design and development of MERRYts, a tool to enable usability evaluation of several back- and frontends and API-functions to get evidence-based information on the best way to support TS-based recording of patient information.

MERRYts is a web based tool. It is built using server side scripting to ensure it can be accessed by various devices. MERRYts uses an existing SNOMED CT-API (SnAPI) and is built using Java, JavaScript and PHP to make it easy to create (3rd party) extensions.

We have implemented several frontends that can be used separately for use in a usability-study. There are various ways of retrieving knowledge from MERRYts, for example output on screen or direct communication with 3rd-party products such as EHRs.

At this moment one TS is implemented, SNOMED CT. This is done through the SnAPI.

New functions in the front- and backend, functions for (extra) data-retrieval, export-options and (usage-) statistics can be added in a relatively simple way because the API of MERRYts enables building an extension that can make use of all functions already built. This creates the possibility to build a custom environment for a particular case (e.g. to test a new GUI against the GUI used in the current EHR).

The number of functions is currently limited. There is however the possibility of adding extra API's to connect MERRYts with other TS or create new functions by building extensions. Also a good mobile-frontend and some EHR-specific bridges for direct data-input into the EHR should be created.

MERRYts is the start for investigating the usability of various GUI/backend combinations. More modules have to be built to get more ways of presentation, but this is a good first start for further research.

**Keywords:** Medical Informatics, Terminology System, Visualization, Research, Webbased Programming, Research on Visualization of Terminology Systems

[1] See the definitions section for used terms and abbreviations.

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# INTRODUCTION

In the past decades the role of the computer in patient record keeping has increased and gradually replaced free-text paper record keeping by electronic free-text information storage.
Now that EHR usage is more common, one wants to profit from the possibilities EHRs bring such as reusing electronic data for research, management information and decision support. This requires better communication, interoperability, between various EHR-systems. To communicate it is important to preserve context and meaning of the data captured. In healthcare, TSs are used for electronic data capturing in a structured and standardized way. These TSs interrelate concepts and make use of codes to identify concepts and terms to describe these concepts. Because there are a lot of TSs and the number of terms can vary a lot (up to several hundred of thousand items) it is important to have a good way of presenting these items in a clear way to the users who have to capture and use the data.

There is a lot of research on usability of software and GUIs. Also, there is a lot of research on searching and search engines. However, research combining these two areas (research on GUI of search engines) is not often performed. This implies that there is not much research available on the best way of presenting large sets of information, like concepts, in such a way that a concept can be most efficient found. Research that is available is often specified on one specific situation(1,2).

# DEFINITIONS

Terms and abbreviations as they are used in this thesis

| | | | |
|---|---|---|---|
| **API** | Application Programming Interface | **OS** | Operating System |
| **Backend** | Part of application processing functions. Backend is not directly accessible by the GUI. | **Servlet** | Java-application running on webserver |
| **EHR** | Electronic Health Record | **Skin** | Custom created GUI available in, and only useable by, MERRYts |
| **(G)UI** | (Graphical) User Interface | **SNOMED CT** | Systematized Nomenclature of Medicine-Clinical Terms |
| **HIS** | Hospital Information System | **Terminology System** | A system which organizes the terms of a domain according to some structure, such as hierarchical indentations, codification or lookup tables.(3) |
| **JRE** | Java Runtime Environment | **TS** | Terminology System |
| **MERRYts** | Medical Electronic Recording-support for Research-based Yammering about Terminology Search | | |

# GOAL OF THE PROJECT

The goal of this project is to build a customizable Terminology search tool, called MERRYts that can be used to present terminology information in a variety of ways. Using MERRYts would give the possibility to make a usability study of various user interfaces for browsing medical TSs. In the end, the results of that study can be used to create a generic user interface for terminology systems with a high degree of acceptance among physicians.

# METHODS

This project is performed in three phases:

- Literature research
- Requirements analysis
- Pilot implementation

## LITERATURE RESEARCH

Literature was searched using the Internet. Goal was to find publications on usability of (medical) search-engines and on usability of medical TSs. These searched where performed on Google, Google Scholar, Google Books, Pubmed.

Article selection was based on the following MeSH- and key terms:

- Medical Terminology GUI
- Medical Terminology Search
- Search Engine Usability
- Medical Terminology Usability
- Terminology Search Usability
- Terminology Search Engine
- Presentation of Medical Terminology

Another search was performed on the library catalog of the University of Amsterdam. Search-actions where restricted on books located at the medical library and library for beta sciences.

Recommendations of colleagues and suggestion from authors of retrieved papers were taken into account to further extend the set of retrieved papers.

## REQUIREMENTS ANALYSIS

Because this is, as far as we know, the first research on the presentation of large sets of data, there are no relevant requirements of other studies found. Apart of common GUI requirements like to put often used functions in main screen. Knowing this, requirements are based on the fact the author wanted to have a research tool with a very high flexibility, regarding functionality, OS support and ‘look and feel’.

The main focus of the requirements analysis was on functionality of mobile devices. MERRYts should be accessible by most devices with an internet connection. Mobile devices lack support for various programming languages. If a web application works on a mobile device, it will almost always also run on personal computers. While there was a desire to build an 'open' tool, e.g. no restrictions in how data is presented to the user, there has been no requirements investigation among future users. The requirements have been based on the idea of creating an API. In this way, it is possible to customize the tool for future research with different front-ends, TS or even complete 3rd-party programs where MERRYts would only be used as connection to different TSs.

## PILOT IMPLEMENTATION

Because the project result is the creation of a tool to be used in usability studies on TSs we focused on functions instead of implementation of a definitive product with all functions present in a GUI.

Because it should be easy for others to create extensions for the project and the project needs to be accessible by different devices.
It is desirable to make the tool web-based. When using Servlets, the user does not need to have a JRE, this makes the product available for some new devices that lack Java-support (like E-readers, some tablets and smart phones).

This resulted in the point of few MERRYts should make use of a few frameworks and libraries:

- The tool is built in 4 combined languages: PHP, HTML, JavaScript and Java.
- Libraries used are the standard libraries for these languages. For Java, the Servlets library is added.

# RESULTS

## LITERATURE RESEARCH

The literature research resulted in a total of 22 pieces of writing looking useful at first sight. After reading, most of them could be excluded. Main reason was the fact that information has become obsolete because of the evolution in computer technology. A second reason was information in the article did not match the subject, which was assumed based on the title.

A total of 4 useful articles(1,3-5) where included. One article(2) was added after contact with one of the authors.

One master thesis(6) and a guideline(7) where added based on recommendations of the daily supervisor.

One book(8) was included.

The literature made clear that user interfaces of search tools have changed a lot since the first usage of search tools on the computer. Most changes are based on the evolution of the computer.

This evolution is the reason why search tools like web based search engines can more and more focus on performance and graphical user interfaces.

The literature also pointed out that various TS had different UI's. There is, at the moment, no golden rule or best practice of presenting this information. After reading the literature, one main conclusion was drawn from all: "There has been no academic research of any importance on this subject."

A search on the Internet resulted in one API to access the knowledge stored in SNOMED CT(9) that was useful, i.e., free, actively developed, flexible. This API is the most important component of MERRYts at this moment. All requests on SNOMED CT TS are passed through this API.

## REQUIREMENTS ANALYSIS

The requirements analysis resulted in a few requirements:

- There had to be an easy way to query SNOMED CT.
- To test the GUI, MERRYts needs to be a 'universal' tool. This implies that it should not depend on environmental variables like be OS, used software, resolution, etc. Also, it should be customizable to be able to create a frontend-backend combination according to the desired interface to test.
- The fact that the program needed to work independent of the environment resulted in the wish to build the tool online. To make sure that the tool works on various systems, also mobile devices, no user side java should be necessarily. As the used SnAPI is Java-based, this results in another requirement. To build the functions for this tool, there is a need for Java; the server needs to support this language.
- To create an easy way of adding functions / GUIs / skins / …, the used tool should be able to work with external extensions.

All mentioned requirements resulted in the choice of PHP and Java. These are commonly used languages so it should ease the creation of extensions.

## IMPLEMENTATION

MERRYts has become a web tool with an open structure. This means that functions can be used in combination with external programs or extensions. You can use the browser to find the concepts you like, in the UI you like. It is relatively easy to add own GUIs and data-sources.

The only implemented TS at this moment is SNOMED CT. This is done through the SnAPI. The SnAPI is an API with a lot of functions. It is a Java-API and is free to use.

Two main functions are implemented:

- Searching SNOMED CT based on a string (possible search-methods are "whole word" or "Phrase search")
- Listing implemented subsets of concepts from SNOMED CT

Both functions can be used in five different implemented skins, each based on one of the following principles, returning information[2] in:

1. plain text
2. a table
3. a list of 'drag and drop' labels and boxes for (to be implemented) post-coordination
4. a CliniClue-like(10) skin
5. a SNOB-like(11) skin

MERRYts can communicate with other programs like EHRs using the API[3] of the tool itself. In theory every GUI / TS can be connected to MERRYts as long as it is able to communicate with Java-based software.

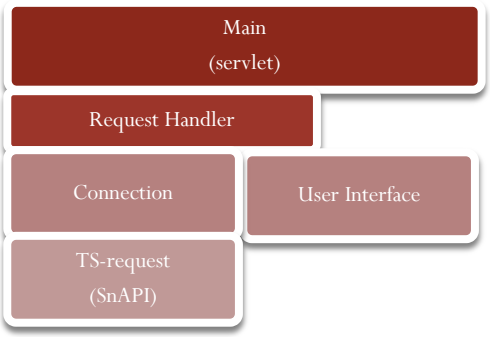


FIGURE 1 COMPONENT HIERARCHY IN MERRYTS

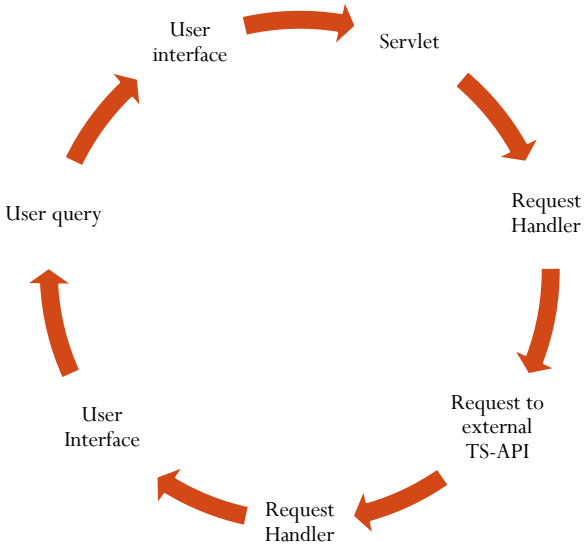


FIGURE 2 FLOW DURING A REQUEST

## DISCUSSION

Although the computer is more and more used in Medical Health Record Keeping and TS are more and more used to capture data in a structured way, there has not yet been good research on usability of Graphical User Interfaces of TSs.

MERRYts is a product that makes it possible to research usability of search GUIs, with a focus on medical Terminology Systems. MERRYts is highly configurable. It can be completely customized to fit in the GUI research project, in terms of search-possibilities, look and feel, and searchable TS.

[2] Numbers refer to subsections in appendix B. These subsections contain screenshots and additional information.
[3] See Appendix A for API-definition

The decision was made not to ask users about desired functions or good / bad current products. Reason for this decision was the idea that no info would give an 'open view' to the problem. This tool should also be able to test new GUIs or GUIs that would otherwise not go into production because, for example, the perception is that some GUIs would not work, based on own experience of the programmer.

MERRYts is built and tested by the author. It has not been tested by others yet. So although it seems to work, it is possible that functions are tested in a complete different way than end-users would do. It is assumed that the open structure gives the opportunity in this case to write an extension that changes the behavior in the desired way.

The biggest advantage of MERRYts is that it enables usability research to support decision on the way TSs should be implemented in an EHR / HIS. Now there is a tool to compare TS GUIs on performance (best registration-results) or usability (user friendly interface).

The programmatic structure of MERRYts enables the possibility of extending the program by 3rd-party extensions. The possibility of extending MERRYts is mainly limited by the skills of the extension-programmer. A second limitation could be the specifications of the used server or network-overhead during usage. But this is only limiting if an extension is high on resource usage.

A next step would be to test the current version of MERRYts on usefulness. That means that we have to test whether it is possible to get significant results on GUI testing by using this tool. After that, some extra TS should be implemented and a pilot-test of GUI comparison using MERRYts should be started.

## CONCLUSION

MERRYts is a web tool that is able to present and search TS in various ways. The tool can retrieve input and present the content of TSs in various ways, by using the API.
The tool is a basis to be used for research on usability of various TS-Search-GUI.

## ACKNOWLEDGEMENTS

I am very grateful for the interest and contribution to the study of the supervisors, students, teachers, colleagues and authors that I've had contact with during the study. Special thanks goes to all those people out of sight for providing an optimal work environment.

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# APPENDIX A – MERRYTS API

## Package nl.mikproject.MERRYts

**DragDrop**
**ResultTemplates**
**RequestHandler**
**SearchByID**
**SearchByText**
**Servlet**
**Settings**
**SubSetHandling**

### nl.mikproject.MERRYts

### Class DragDrop

```
java.lang.Object
      |
      +--nl.mikproject.MERRYts.DragDrop
            public class DragDrop
                  extends java.lang.Object
```

**Author:**
WPME Hofland

#### DragDrop

```
public DragDrop()
```

Method for building a drag/drop template

#### showSite

```
public java.lang.String showSite(java.util.ArrayList
listOfDragItems, int locationOfTitle, int labelposition, int
locationOfID, boolean multipleDropboxes)
```

Method to get a html-string to present a drag-drop site in a browser

**Parameters:**
`listOfDragItems` - Items that should be in labels to drag/drop
`locationOfTitle` - The index of the title to show on the label
`labelposition` - The index of the label of the boxes
`locationOfID` - Location of the ID in the listOfDragItems
`multipleDropboxes` - True if multiple boxes should be shown. False if one is shown (for example when presenting subsets)

**Returns:**
HTML-string to present in browser

**nl.mikproject.MERRYts**

## Class ResultTemplates

```
java.lang.Object
      |
      +--nl.mikproject.MERRYts.ResultTemplates
            public class ResultTemplates
                  extends java.lang.Object
```

**Author:**
WPME Hofland

### ResultTemplates

```
public ResultTemplates()
```

### buildCliniClueLikeResponse

```
public java.lang.String
buildCliniClueLikeResponse(java.util.ArrayList infoImported,
boolean isTextSearch)
```

Build a skin presenting the information in a CliniClue-like environment

**Parameters:**
`infoImported` - ArrayList containing subsets or categories. See the SearchByText Class for information about the order of strings
`isTextSearch` - True if infoImported contains labels and categories. False if it contains subsets

**Returns:**
HTML-string Presenting infoImported in a CliniClue-like environment

### buildColorTableResponse

```
public java.lang.String
buildColorTableResponse(java.util.ArrayList infoImported,
boolean isTextSearch)
```

Prepare a template containing a Table

**Parameters:**
`infoImported` - An arraylist containing information fetched from a TS. See the SearchByText Class for information about the order of strings
`isTextSearch` - True if infoImported is an array of retrieved terms and various categories. False if it is a list of subsets.

**Returns:**
Html-string containing send information. Formatted in a table highlighted in various colors.

### buildDefaultColorTableResponse

```
public java.lang.String
buildDefaultColorTableResponse(java.util.ArrayList infoImported)
```

Create a table response using colors

**Parameters:**

`infoImported` - an arraylist of terminological information. See the SearchByText Class for information about the order of strings

**Returns:**

HTML-string containing send information. Formatted in a table highlighted in various colors.

### buildDefaultTableResponse

```
public java.lang.String
buildDefaultTableResponse(java.util.ArrayList infoImported,
boolean useColor)
```

Build a table response with or without colors. Used to create tables for subsets

**Parameters:**

`infoImported` - An arraylist containing subsets.
`useColor` - True if the table needs to use an alternate color to present the ID.

**Returns:**

HTML-string presenting a table with information set by infoImported

### buildDragDropSite

```
public java.lang.String buildDragDropSite(java.util.ArrayList
listOfDragItems, int type, java.lang.String searchText)
```

Builds a template presenting data in a drag and drop environment used to create functions like post-coordination

**Parameters:**

`listOfDragItems` - Arraylist of items. Positions needs to be formatted in this way: (**index = content(type=1)/content(type=2)**) 0 = label/conceptID, 1 = title of target box/-, 2 = conceptID/title of target box, 3 = -/label
`type` - type of presentation of target-boxes. 1 = use 1 target-box. 2 = use multiple target boxes. Default is 1.
searchText - Text used to fetch items found in listOfDragItems

**Returns:**

HTML-string Presenting listOfDragItems in a DragDrop environment

### buildPlainResponse

```
public java.lang.String buildPlainResponse(java.util.ArrayList
information, boolean isTextSearch)
```

Returns a string of all information set by information

**Parameters:**
`information` - Arraylist presenting data.
`isTextSearch` - True if information contains concepts and categories, False if information contains subsets

**Returns:**
A string presenting al data. Information on one item is separated by a tab \\t. Items are separated by a return \\n

### buildSnobLikeResponse

```
public java.lang.String
buildSnobLikeResponse(java.util.ArrayList infoImported, boolean
isTextSearch)
```

Create a template presenting information in a SNOB-like environment

**Parameters:**
`infoImported` - An arraylist with data to present. See the SearchByText Class for information about the order of strings
`isTextSearch` - True if infoImported contains concepts and categories. False if it contains subsets

**Returns:**
HTML-string presenting the SNOB-like environment

### buildTextColorTableResponse

```
public java.lang.String
buildTextColorTableResponse(java.util.ArrayList infoImported)
```

Build a table response with colors. Used to create tables with IDs, concepts, categories and weight

**Parameters:**
`infoImported` - An arraylist containing subsets.

**Returns:**
HTML-string presenting a table with information set by infoImported

### buildTextColorTableResponse

```
public java.lang.String
buildTextColorTableResponse(java.util.ArrayList infoImported,
boolean useColor)
```

Build a table response with colors. Used to create tables with IDs, concepts, categories and weight

**Parameters:**
`infoImported` - An arraylist containing subsets.
`useColor` - True if the table needs to be presented using colors for various types of information

**Returns:**
HTML-string presenting a table with information set by infoImported

### setIDLocation

```
public void setIDLocation(int locationOfIDInArray)
```

Sets the location of the ID in an Array. If this option is set, the table column with the ID will turn green

**Parameters:**

`locationOfIDInArray` - Location of ID in array. -1 if no ID available. Default: -1.

### setResponseType

```
protected void setResponseType(int desiredResponse)
```

Store type of desired Response

**Parameters:**

`desiredResponse` - value representing the skin to be stored

---

## nl.mikproject.MERRYts

---

### Class SearchByID

```
java.lang.Object
      |
      +--nl.mikproject.MERRYts.SearchByID
            public class SearchByID
                  extends java.lang.Object
```

**Author:**

WPME Hofland

### SearchByID

```
public SearchByID()
```

Class containing functions to use on searching by ID.

### getConceptByID

```
public java.lang.String getConceptByID(java.lang.Long ID)
```

Get name of concept based on ID

**Parameters:**

`ID` - ID of concept to display

**Returns:**

Name of concept

### getConceptDescription

```
public java.lang.String getConceptDescription(java.lang.Long
ID, java.lang.String separator)
```

Get description of a concept

**Parameters:**

`ID` - ID of the concept to search for

`separator` - separator to use for separating various part (like \\n or "<"br">")

**Returns:**
String containing various parts of description separated by separator

### getNeighbourIDsOfConcept

```
public java.util.ArrayList
getNeighbourIDsOfConcept(java.lang.Long ID)
```

Get neighbors ID's of a concept

**Parameters:**
`ID` - ID of concept you want neighbour ID's to be displayed

**Returns:**
Arraylist of neighbourIDs

### getNeighbourIDsOfConcept

```
public java.lang.String getNeighbourIDsOfConcept(java.lang.Long
ID, java.lang.String separator)
```

Get IDS of Neighbour concepts separated by separator

**Parameters:**
`ID` - ID you want to see neighbours of
`separator` - string to separate neighbours with

**Returns:**
String of neighbours separated by separator

### getNeighboursOfConcept

```
public java.lang.String getNeighboursOfConcept(java.lang.Long
ID, java.lang.String separator)
```

Get neighbours of concept

**Parameters:**
`ID` - ID to get neighbours of
`separator` - string to separate neighbours

**Returns:**
ID's of the neighbours given by ID, separated by separator

### getNeighboursOfConceptByID

```
public java.lang.String
getNeighboursOfConceptByID(java.lang.Long ID, java.lang.String
separator)
```

Get names of the neighbours of concept given by ID

**Parameters:**
`ID` - ID of concept you want to show neighbours of
`separator` - String to separate various neighbours

**Returns:**
String containing neighbour names, separated by separator

## nl.mikproject.MERRYts

### Class SearchByText

```
java.lang.Object
      |
      +--nl.mikproject.MERRYts.SearchByText
            All Implemented Interfaces:
                  java.io.Serializable
            public class SearchByText
                  extends java.lang.Object
                  implements java.io.Serializable
```

**Author:**
WPME Hofland

#### SearchByText

```
public SearchByText()
```

Class containing methods to communicate with the external SnAPI

#### getInfo

```
public java.util.ArrayList getInfo()
```

Returned information arraylist contains:

0 ConceptID
1 Fully Specified Name
2 Fully specified Name minus Type
3 Type of concept
4 Weight (likelihood this is the item searched for)
5 CTV3ID

**Returns:**
An arraylist containing requested information

#### getListOfDescriptions

```
public static
org.datacontract.schemas._2004._07.snapiwcfservice.ArrayOfDescr
iption[] getListOfDescriptions()
```

Get a list of descriptions of concepts

**Returns:**
A list of Descriptions of concepts

### getSearchText

```
public java.lang.String getSearchText()
```

Get the current stored search text

**Returns:**

Current stored search text

### setMatchtype

```
public void setMatchtype(int type)
```

Set the match-type to use

**Parameters:**

`type` – 'match type'. 0 = Exact Word, 1 = Phrase Search

### setMaxResults

```
public void setMaxResults(int maxResults)
```

Set the maximum results to show

**Parameters:**

`maxResults` - maximum number of results to show

### setResponsType

```
public void setResponsType(int response)
```

Set the type of response (template) you want to get

**Parameters:**

`response` - type of response.

### setSearchText

```
public void setSearchText(java.lang.String searchText)
```

Set the string to use for searching

**Parameters:**

`searchText` - string to search for

**nl.mikproject.MERRYts**

## Class Servlet

```
java.lang.Object
      |
      +--HttpServlet
            |
            +--nl.mikproject.MERRYts.Servlet
                  public class Servlet
                        extends HttpServlet
```

**Author:**
WPME Hofland

### Servlet

```
public Servlet()
```

### doGet

```
protected void doGet(HttpServletRequest request,
HttpServletResponse response) throws null, java.io.IOException
Handles the HTTP GET method.
```

**Parameters:**
`request` - servlet request
`response` - servlet response

**Throws:**
`null` - if a servlet-specific error occurs
`java.io.IOException` - if an I/O error occurs

### doPost

```
protected void doPost(HttpServletRequest request,
HttpServletResponse response) throws null, java.io.IOException
Handles the HTTP POST method.
```

**Parameters:**
`request` - servlet request
`response` - servlet response

**Throws:**
`null` - if a servlet-specific error occurs
`java.io.IOException` - if an I/O error occurs

### getServletInfo

```
public java.lang.String getServletInfo()
```

Returns a short description of the servlet.

**Returns:**
A string containing servlet description

### processRequest

```
protected void processRequest(HttpServletRequest request,
HttpServletResponse response) throws null, java.io.IOException
```

Default method called when site is requested

**Parameters:**

`request` - http-requests
`response` - http-response

**Throws:**

`null` - if a servlet-specific error occurs
`java.io.IOException` - if an I/O error occurs

---

## nl.mikproject.MERRYts

### Class Settings

```
java.lang.Object
      |
      +--nl.mikproject.MERRYts.Settings
            public class Settings
                  extends java.lang.Object
```

**Author:**

WPME Hofland

### Settings

```
protected Settings()
```

Class used to get global settings

### getGuid

```
protected static java.lang.String getGuid()
```

ID for the SnAPI

**Returns:**

SnAPI GUID

---

## nl.mikproject.MERRYts

### Class SubSetHandling

```
java.lang.Object
      |
      +--nl.mikproject.MERRYts.SubSetHandling
            public class SubSetHandling
                  extends java.lang.Object
```

**Author:**
WPME Hofland

### SubSetHandling

```
public SubSetHandling()
```

Class presenting functions used for working with subsets

### getInfo

```
public java.util.ArrayList getInfo()
```

Get an arraylist of subsets available in the SnAPI

**Returns:**
Arraylist of subsets available in the SnAPI

---

## nl.mikproject.MERRYts

---

### Class RequestHandler

```
java.lang.Object
      |
      +--nl.mikproject.MERRYts.RequestHandler
            public class RequestHandler
                  extends java.lang.Object
```

**Author:**
WPME Hofland

### RequestHandler

```
public RequestHandler()
```

Basic Class for calling the right template, starting the right request function, etc.

### buildResponse

```
public void buildResponse(java.util.ArrayList information)
```

Method to fit found information into a template

**Parameters:**
`information` - List with data to present in a template

### getConceptByText

```
public java.lang.String getConceptByText()
```

Get concepts based on text set in the setSearchKey method

**Returns:**
HTML-formatted response

### getConceptByText

```
public java.lang.String getConceptByText(java.lang.String text)
```

Get a formatted response based on searched text

**Parameters:**
`text` - text to search for

**Returns:**
HTML-formatted response

### getConceptByText

```
public java.lang.String getConceptByText(java.lang.String text,
int desiredResponse)
```

Get concept based on searched text, formatted as desired

**Parameters:**
`text` - text to search for
`desiredResponse` - response desired

**Returns:**
HTML-string presenting concepts searched by text

### getConceptByText

```
public java.lang.String getConceptByText(java.lang.String text,
int desiredResponse, int searchType)
```

Get a HTML-formatted string containing concepts.

**Parameters:**
`text` - text to search
`desiredResponse` - type of response (template)
`searchType` - Type of search. 0 = whole word, 1 = phrase search

**Returns:**
HTML-formatted string containing concepts fetched by searching on text by searchType. Formatted as set in desiredResponse.

### getListOfSubsets

```
public java.lang.String getListOfSubsets()
```

Get a list of subsets implemented in the SnAPI

**Returns:**
String containing a list of available subsets

### getListOfSubsets

```
public java.lang.String getListOfSubsets(int ResponseType)
```

Return a list of subsets based presented in various ways

**Parameters:**
`ResponseType` - type of presentation

**Returns:**
HTML-string containing list of subsets available in the SnAPI

### setIDLocation

```
public void setIDLocation(int locationOfIDInArray)
```

Sets the location of the ID in an Array. If this option is set, the table column with the ID will turn green

**Parameters:**

`locationOfIDInArray` - Location of ID in array. -1 if no ID available. Default: -1.

### setNumberOfResults

```
public void setNumberOfResults(int results)
```

Set the maximum number of results to be fetched

**Parameters:**

`results` - maximum number to be fetched

### setResponseType

```
public void setResponseType(int desiredResponse)
```

Set the type of response (template) you want to get

**Parameters:**

`desiredResponse` - type of response you want. 0 = Plain text. 1 = Colored Table. 2 = Snob like. 3 = DragDrop. 4 = CliniClue like. Default = 1. On out of bound, default = 0.

### setSearchKey

```
public void setSearchKey(java.lang.String text)
```

Set the term to search for

**Parameters:**

`text` - text to search for

### setSearchMode

```
public void setSearchMode(int type)
```

Set the search mode for text based search. See SearchByText.setMatchType(int type) for available options.

**Parameters:**

`type` - type of search used

## Package nl.mikproject.MERRYts.Support

### ShortCuts

**nl.mikproject.MERRYts.Support**

## Class ShortCuts

```
java.lang.Object
      |
      +--nl.mikproject.MERRYts.Support.ShortCuts
            public class ShortCuts
                  extends java.lang.Object
```

**Author:**
WPME Hofland

### ShortCuts

```
public ShortCuts()
```

Class presenting some common used tasks

### findBiggestInt

```
public static int findBiggestInt(int a, int b)
```

Get the biggest integer out of two integers

**Parameters:**
`a` - Integer A
`b` - Integer B

**Returns:**
Biggest integer of A and B. If A and B are equal, B is returned

# APPENDIX B – WAYS OF INFORMATION-PRESENTATION IN MERRYTS

This appendix shows the various ways of output available in MERRYts. When a screenshot of a search-output is demonstrated, the term Diabetes is used. A limitation of returning 100 terms is set. The search-method is set on “Phrase Search”, meaning a term matches when the searched string is available as a (part) of the term.

## B.1 PLAIN TEXT

The plain text modus is used as a demonstration modus. Output in this mode is a presentation of data that as it is returned when you use the API to retrieve information with an extension.

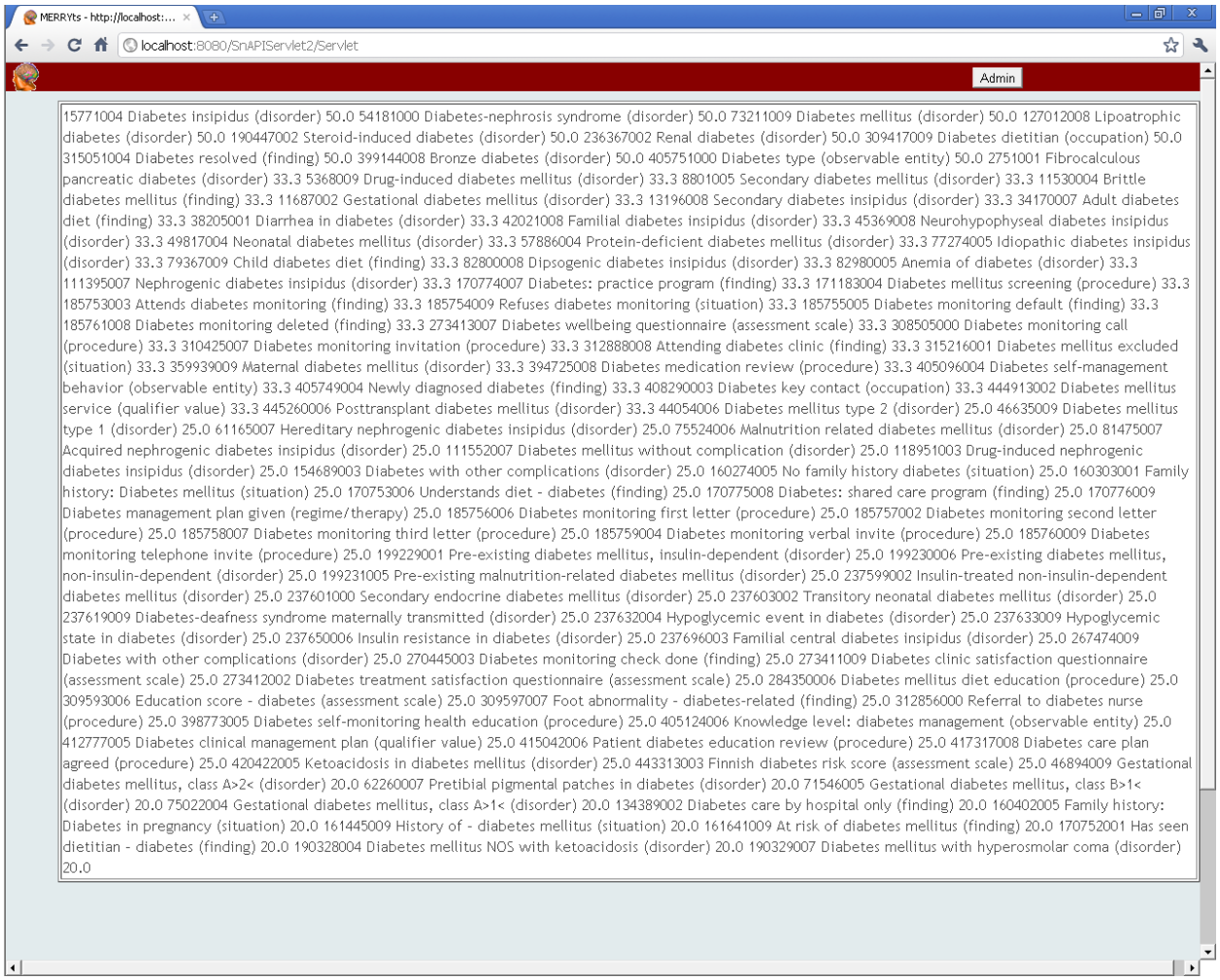
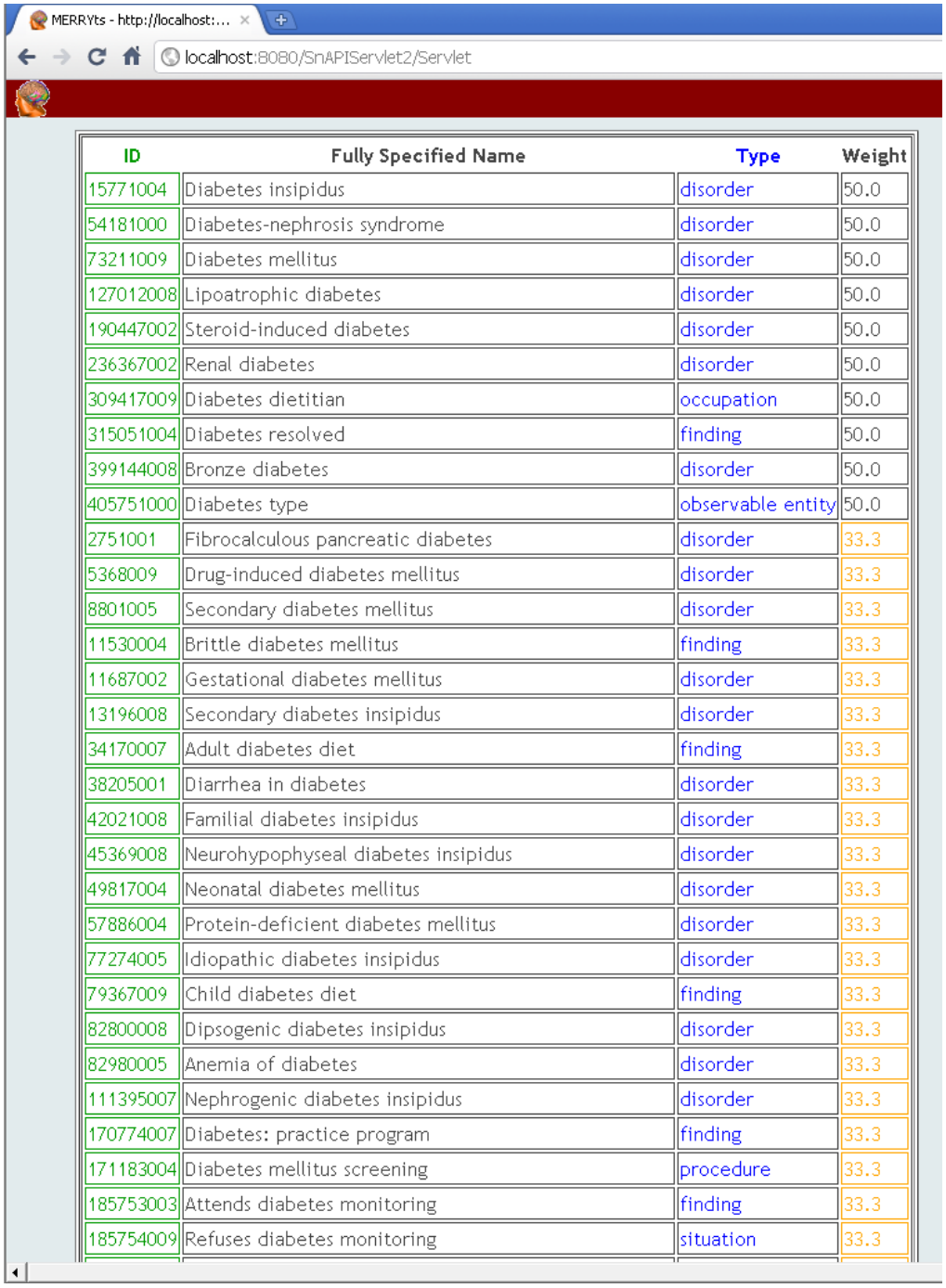



FIGURE 3 PLAIN TEXT OUTPUT

## B.2 TABLE

The table presentation shows the result of a search, presenting the ID, name, category and weight (likelihood of the current concept being the searched concept). Likelihood can be influenced by configuration of the researcher or (if allowed by the researcher) the end-user.




| ID | Fully Specified Name | Type | Weight |
|---|---|---|---|
| 15771004 | Diabetes insipidus | disorder | 50.0 |
| 54181000 | Diabetes-nephrosis syndrome | disorder | 50.0 |
| 73211009 | Diabetes mellitus | disorder | 50.0 |
| 127012008 | Lipoatrophic diabetes | disorder | 50.0 |
| 190447002 | Steroid-induced diabetes | disorder | 50.0 |
| 236367002 | Renal diabetes | disorder | 50.0 |
| 309417009 | Diabetes dietitian | occupation | 50.0 |
| 315051004 | Diabetes resolved | finding | 50.0 |
| 399144008 | Bronze diabetes | disorder | 50.0 |
| 405751000 | Diabetes type | observable entity | 50.0 |
| 2751001 | Fibrocalculous pancreatic diabetes | disorder | 33.3 |
| 5368009 | Drug-induced diabetes mellitus | disorder | 33.3 |
| 8801005 | Secondary diabetes mellitus | disorder | 33.3 |
| 11530004 | Brittle diabetes mellitus | finding | 33.3 |
| 11687002 | Gestational diabetes mellitus | disorder | 33.3 |
| 13196008 | Secondary diabetes insipidus | disorder | 33.3 |
| 34170007 | Adult diabetes diet | finding | 33.3 |
| 38205001 | Diarrhea in diabetes | disorder | 33.3 |
| 42021008 | Familial diabetes insipidus | disorder | 33.3 |
| 45369008 | Neurohypophyseal diabetes insipidus | disorder | 33.3 |
| 49817004 | Neonatal diabetes mellitus | disorder | 33.3 |
| 57886004 | Protein-deficient diabetes mellitus | disorder | 33.3 |
| 77274005 | Idiopathic diabetes insipidus | disorder | 33.3 |
| 79367009 | Child diabetes diet | finding | 33.3 |
| 82800008 | Dipsogenic diabetes insipidus | disorder | 33.3 |
| 82980005 | Anemia of diabetes | disorder | 33.3 |
| 111395007 | Nephrogenic diabetes insipidus | disorder | 33.3 |
| 170774007 | Diabetes: practice program | finding | 33.3 |
| 171183004 | Diabetes mellitus screening | procedure | 33.3 |
| 185753003 | Attends diabetes monitoring | finding | 33.3 |
| 185754009 | Refuses diabetes monitoring | situation | 33.3 |

FIGURE 4 PRESENTED AS A TABLE

## B.3 LIST OF DRAG AND DROP LABELS

This output can be used to post-coordinate SNOMED-concepts. Labels can be dragged to boxes. A check is performed to see if a label is dragged into the right box. In this way a first validation test can be performed. E.g. an infection have a causative agent bacteria x. An infection can have a location lung. An infection can't have a location bacteria x.

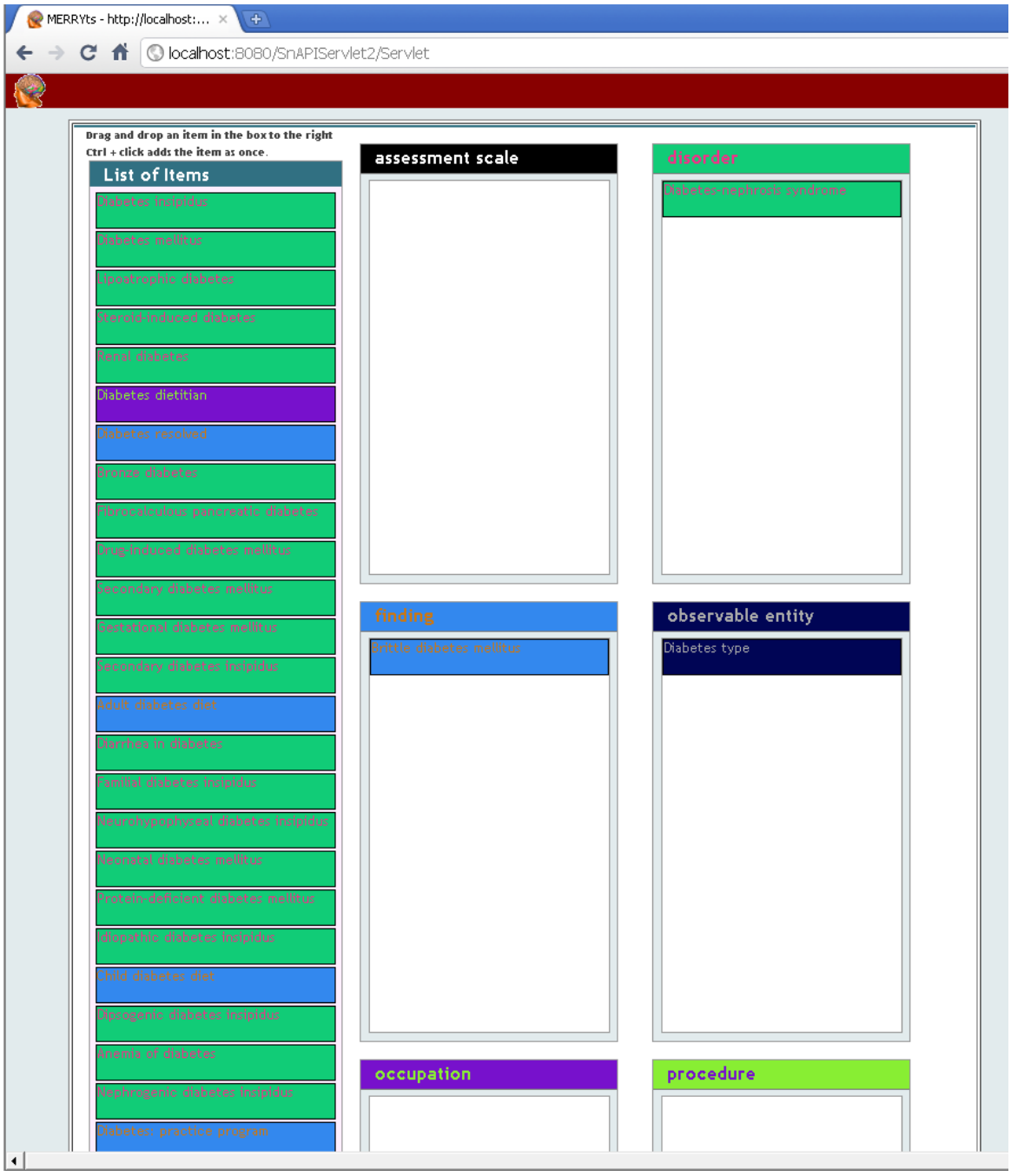



FIGURE 5 DRAG AND DROP LABELS

## B.4 CLINICLUE-LIKE SKIN

CliniClue is a “freeware browser for SNOMED Clinical Terms®”. The current implementation in MERRYts is limited to the main screen. Only the search-function is implemented. The screen shows additional information on a concept like relations, hierarchy and current concept-status.

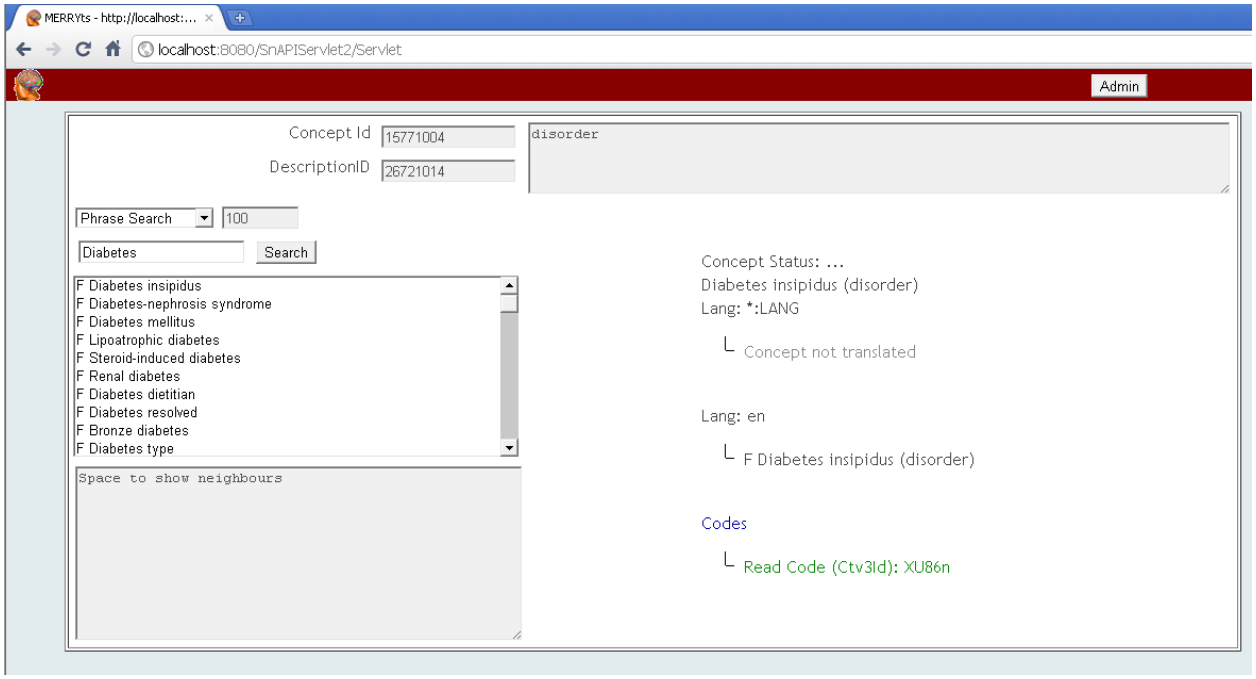



FIGURE 6 SKIN BASED ON CLINICLUE

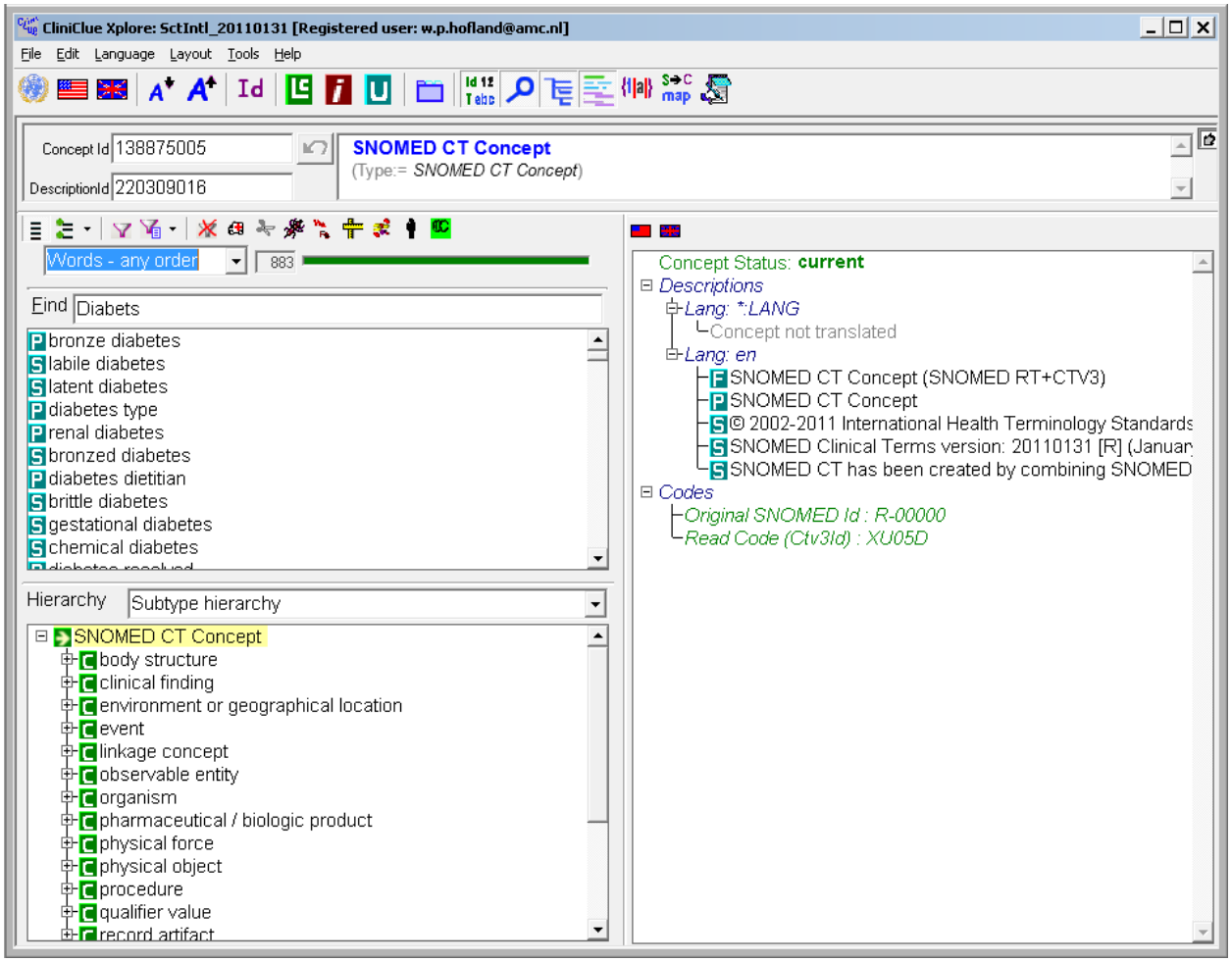



FIGURE 7 AN ORIGINAL CLINICLUE SCREEN

## B.5 SNOB-LIKE SKIN

SNOB is a SNOMED Browser. It shows concepts in a tree grouped by categories. The fact that different main-categories are shown can be explained by the fact that a concept in SNOMED CT can be in different categories at the same time. This implementation in MERRYts does not look at the importance of a category. The first found category is shown as the main-category.

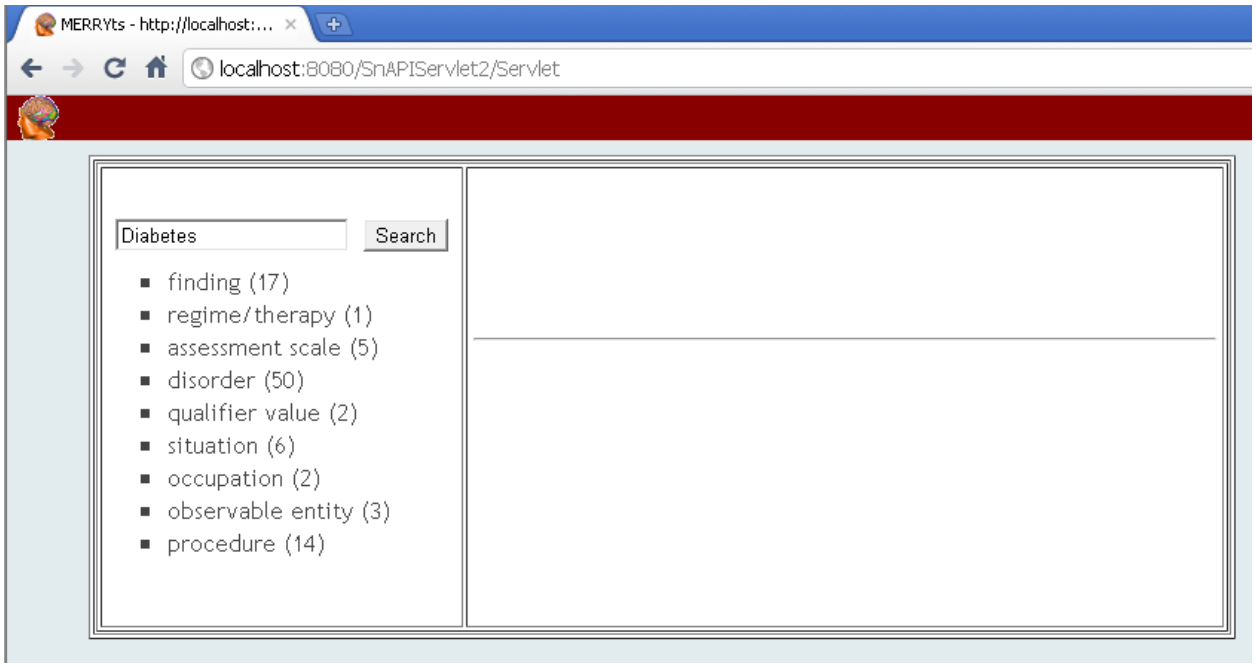



FIGURE 8 SKIN BASED ON SNOB

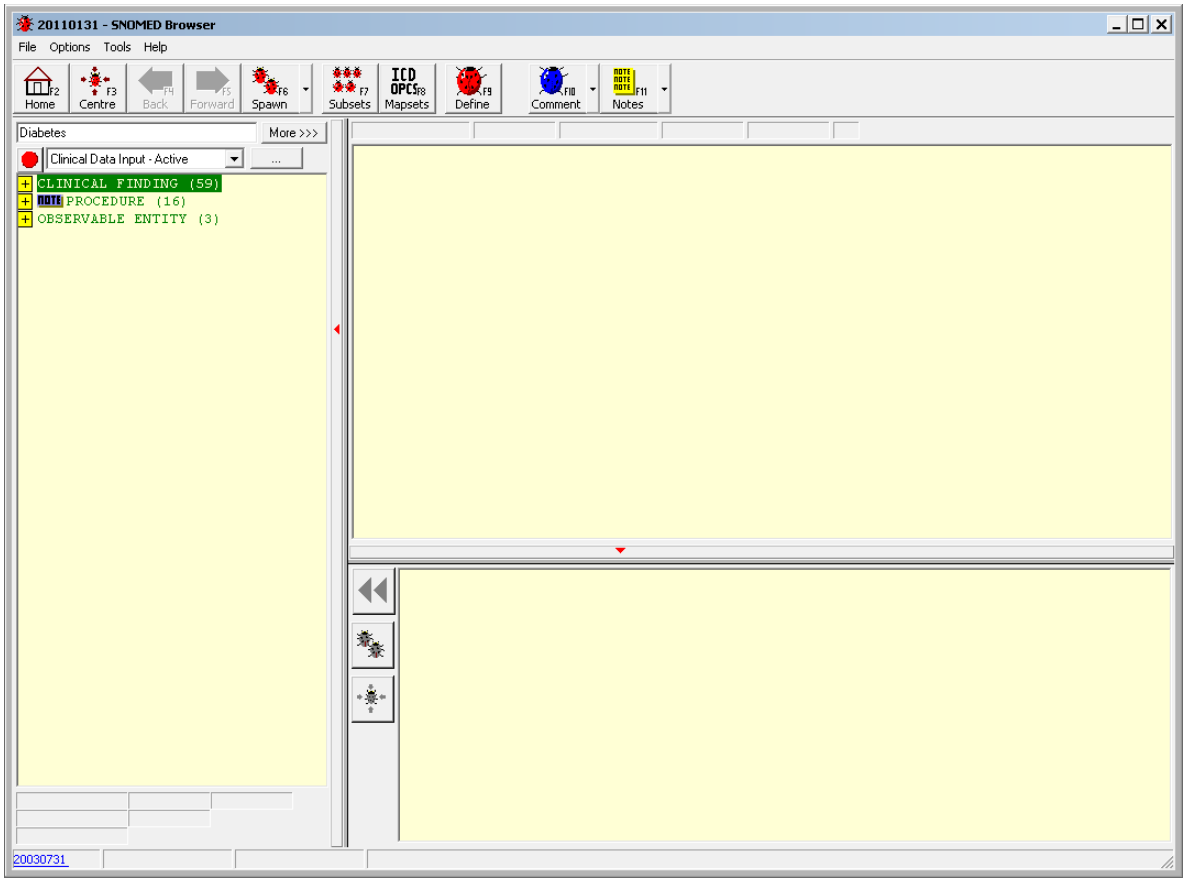



FIGURE 9 AN ORIGINAL SNOB SCREEN

## B.6 THE ADMINISTRATION-SECTION

The administration-section can be shown by clicking on a button at the top of the screen. It is shown on the left side of MERRYts and is used to set the current interface. This part of MERRYts is typically only shown to the researcher that wants to use the tool in a usability evaluation of TS GUIs; the end-user user of the TS itself should not be able to get into this section.

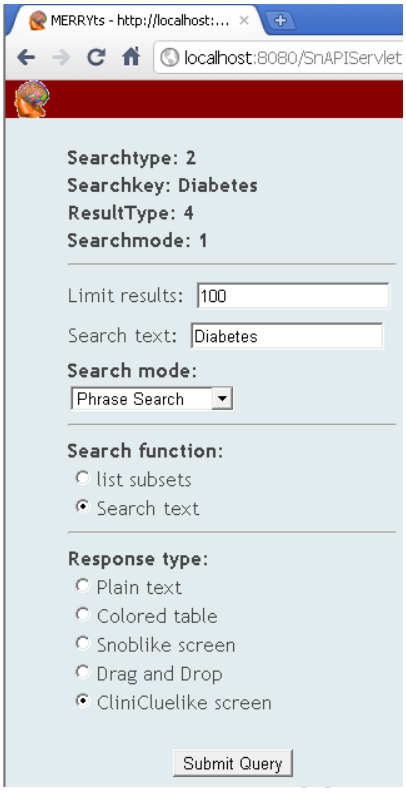



FIGURE 10 THE ADMINISTRATION SECTION

## B.7 LIST OF IMAGES